THE

ELECTRICAL REVIEW.

VOL. LXII. JUNE 5, 1908. No. 1,593.

ELECTRICAL REVIEW.

Vol. LXII.] CONTENTS: June 5, 1908. [No. 1,593.

	Page
What is a Private Telephone?	933
The Effect of Trade Unionism on Industry	934
All-British Cables	934
Electric Wiring Risks	934
The Rating of a Light Railway	935
The Commercial Conditions of Electric Railway Construction	935
The Protection of Electric Motors and Apparatus against Firedamp (*illus.*)	936
New Cable-Transport Carriage (*illus.*)	937
Legal	937
Parliamentary	938
Municipal Tramways Association	942
Correspondence	942
New Electrical Devices, Fittings, and Plant (*illus.*)	945
Business Notes	947
Notes	956
City Notes	958
Stocks and Shares	960
Electric Tramway and Railway Traffic Returns	960
Share List of Electrical Companies	961
Metal Market.—Fluctuations in May	963
The Measurement of Electrical Conductivity (*illus.*)	963
Reviews	965
Charges for Electrical Energy	966
Proceedings of Institutions:—	
Comparison of the Board of Trade Ampere-Standard Balance with the Ayrton-Jones Current-Weigher	967
The Pyrometric Installation in the Gun Section, Royal Gun and Carriage Factories, Woolwich (*illus.*)	968
Steam Turbines for Mill Power	969
The Faraday Society	970
Trade Statistics of the Straits Settlements, 1906	970
Electricity at a Mint	971
New Patents Applied For, 1908	972
Published Specifications	972

THE ELECTRICAL REVIEW.

Published every FRIDAY Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

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OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGREKAY, LONDON." Code, A B C.

Telephone Nos. Holborn 933 Central 4425 (Editorial only).

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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOUVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London), to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S),

1908 EDITION

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

WHAT IS A PRIVATE TELEPHONE?

THE Court of Appeal have recently been called up to consider the scope and extent of the Postmaster-General's telegraph and telephone monopoly. The decision at which they have arrived is of considerable importance to the public. The question arose upon Sec. 5 of the Telegraph Act, 1869, which excepts from the Postmaster's monopoly the following—namely, (1) Telegrams, in respect of the transmission of which no charge is made, transmitted by a telegraph maintained or used solely for private use, and relating to the business or private affairs of the owner thereof; (2) telegrams transmitted by a telegraph maintained for the private use of a corporation, company or person, and in respect of which, or of the collection, receipt and transmission or delivery of which, no money or valuable consideration shall be, or be promised to be, made or given.

It was decided many years ago that the word "telegram" used in these sub-sections includes "telephone." In the case under notice, it was shown that the National Telephone Co. had a licence to work and use telephones enabling persons to communicate with one another on payment of a royalty of 10 per cent. A portion of their business is to supply and maintain for annual payments telephonic lines and instruments between two places, so as to afford communication between those two places alone, these lines, although maintained by the company, being used without the intervention of their servants. The company contended that this class of telephone came within the exceptions above mentioned. Thus it was contended that the telephone used by a theatre ticket agency to connect an office with various hotels and theatres, and a telephone for communication between a fire station and other buildings, were within the exception. The case came before Mr. Justice Swinfen Eady in the first instance. He decided that in order that a telephone may come within the exception of Sec. 5, of a "telegraph maintained or used solely for private use," the communications must all relate to the business or private affairs of the owner thereof. The exception, he said, applied only where branches of the same business are connected by telegraph. It did not apply where two businesses belonging to different persons were connected by telegraph, although the wire might be owned or rented by the owner of one of the businesses. He accordingly held that royalties were payable in respect of the telephones above mentioned.

The Court of Appeal have taken a different view, and their opinion may be gathered from the following passage in Lord Justice Moulton's judgment:—"The Legislature intended that private telegraphs should be outside the monopoly of the Post Office to this extent, that such a telegraph may be used for sending telegrams relating to the business or private affairs of the owner, and that he is at liberty to deal with such telegrams when received just in the same way as he may deal with a message sent without the intervention of a

telegraph. If, therefore, a firm choose to establish private telegraphs to their bankers or their customers for the convenience of their business, and make no charge for the transmission, collection, receipt, or delivery of any of the messages sent thereby, they appear to be well within the exception. Nor does it matter whether the actual wires belong to them or are only leased by them." A further point, as to the scope of the licence given to the National Co. was also raised, but it does not affect the principle of the decision above stated. What is the plain result of the case? A man may have a telephone between his house and his stable; between his house and his solicitor's office; or a number of branches of the same bank may be connected up by means of private wires. In none of these cases need there be any royalties paid to the Postmaster-General.

Further, it need not be shown that the person or persons who enjoy the use of these private lines are the actual owners of them. They may pay rent therefor to the National Telephone Co.

Having regard to the great saving of time and trouble which can be effected by dispensing with the public exchange, this important decision of the Court of Appeal ought to have effect to increase the popularity of the private wire.

The Effect of Trade Unionism on Industry.

Some correspondence has recently appeared in the columns of the *Pall Mall Gazette*, in which certain writers maintain that Trade Unionism has improved matters for the working classes generally. An ex-director of a London engineering firm writes controverting *in toto* this claim. He maintains that, had it not been for Trade Unions, the trade of England would have been many times what it is now, and instead of meeting unemployed everywhere, there would have been work and to spare for every industrious man. In support of his argument, he calls attention to the fact that Trade Unions limit the number of apprentices so that only a small proportion of the working population are permitted by them to learn a skilled trade, with the result that the unskilled labour market is overcrowded, and sweating is rife.

Replying to the statement that "ca' canny" is no part of the policy of Trade Unions, he reminds us that in the bricklaying trade the Unionists are restricted as to the number of bricks they may lay per day, and that in the engineering trade, Unionists insist on one man working one machine only. In America, he says, one workman will look after half-a-dozen machines, so that if he gets paid three times the wages of an English workman, he is still twice as cheap.

After criticising the thriftlessness of the British workman, who often draws as much as £4 and £5 a week, never saves a 6d., and gives his wife £1 out of it to support the family, he agrees that whilst it may be true that the Unionist has benefited himself, it has been at the expense of the rest of the working classes and of the State.

Much of what this correspondent says is undoubtedly true, and there is no denying the fact that so far as engineering work is concerned, the action of Trade Unions in this country has had the effect of driving a great deal of work abroad. The position, however, is not so bad now as it might have been, thanks to the energetic and united action of the engineering employers, who have met combination with combination. The limitation of apprentices, and of the amount of work which one man was permitted to do, were certainly points which the Trade Unions tried to enforce a few years ago, and undoubtedly would have done if the masters had not pulled together. There is little doubt that employers in other trades will have to combine in much the same way as the engineering employers have done, in order to escape the tyranny of Trade Unionism. The recurring troubles in the printing trade amply bear out all that "Ex-Director" says. Take only the recent case of the strike at Messrs. Alabaster, Passmore and Sons' London works. Here is a case where there was practically no dispute and no dissatisfaction among the men with the conditions of work; most of the men were very old servants of the firm, and yet the whole of the employés, including machine-minders, girls, compositors, &c., were called out, because the compositors objected to the way in which this firm conducted their business at a country works near Maidstone, over 30 miles from the London works at which the strike occurred. Not content with this, they distributed libellous circulars at the doors of the Metropolitan Tabernacle, reflecting upon one of the leading members of the firm, who happens to be the treasurer for the Tabernacle. The works were picketed night and day for many weeks, and everything possible was done by the Unions to prevent Messrs. Alabaster, Passmore & Sons carrying on their work. It is almost impossible to conceive what the state of affairs would have been in this country had the whole of the printing employers combined and shut down all their works simultaneously, as the Engineering Employers' Federation recently threatened to do. This, however, is the direction in which things are tending, and combination can only be met by combination. Whilst we recognise that workmen may have grievances which require readjustment, we are bound to agree with those who hold that the action of Trade Unions in the past has hampered industry generally in this country, and driven a large amount of work abroad.

All-British Cables.

In the House of Commons recently the Postmaster-General stated that there had been no suggestion from the Colonies respecting an increase of cable communications between them and the Mother Country, nor had any recent arrangements for that purpose been made.

Mr. Lloyd-George at the Imperial Conference stated that Sir Joseph Ward had brought forward three practical proposals, one of which was "The improvement and cheapening of cable communication with this country," to which he replied, "that it would be an undoubted advantage, and we ought to shorten the distance between ourselves and the Colonies." Is not this a distinct Government proposal and acceptance? The question as to increasing telegraphic intercourse between the Mother Country and the various Colonies is one the principle of which has been accepted, but the work still remains uncompleted.

Electric Wiring Risks.

From time to time we read of fires whose origin is put down to defective electric wiring, although it is very rarely that any details are given which would enable the true cause to be determined.

The National Electrical Inspectors' Association of America publishes reports from time to time which throw considerable light upon the causes of electric fires which occur in the States. These are almost invariably due to old-fashioned and obsolete apparatus or fittings, and in a recent number of *Insurance Engineering* illustrations are given of some of these. They include various types of antiquated switches, ceiling roses and open type fuses mounted on wood bases. The cut-outs noted as being particularly bad in design are the "bug," "Sawyer-Mann" and "horse-shoe canopy" types. The enclosed type of fuse is recommended by the Inspectors' Association as the safest from the point of view of fire risk.

Another prolific source of trouble is flexible cord, which, it is considered, is made far too flexible, so that it is easily tied in knots and put to uses for which it was never

intended. It is thought that if flexible were not quite so flexible there would be fewer accidents.

The use of such cut-outs, fuses, wooden rosettes and ceiling roses, still prevalent in the States, has long been discontinued here owing, no doubt, to the fact that the normal pressures of supply are much higher than those prevailing in America. A pressure of supply of 200 or 220 volts is now so common that most standard apparatus and accessories will safely stand this pressure without arcing over, overheating or break-down, when used for the purposes and in the manner for which they are designed.

The Underwriters' National Electrical Association of America have adopted a system of registration for fittings which meet with their approval, and it is interesting to note that the electrical trade journal *Electrocraft* accepts advertisements only for apparatus and accessories which have the Association's approval.

The Rating of a Light Railway.

THE case of the Wakefield Corporation *v.* Wakefield and District Light Railway Co., which was recently decided in the House of Lords, and of which we gave a brief report several weeks ago, finally settles a question of very great financial moment to electric tramway companies. Complaint is loud that the business of a tramway company is seriously hampered by the burden of local rates. Condemned as they are, to keep a large part of the highway in permanent repair, they are also saddled with an annual charge which often goes far to reduce their dividends to the vanishing point. The case under review serves to emphasise the fact that there is a distinction of great importance between the liability of a tramway company and that of a light railway company. It has now been definitely decided that a light railway which is authorised by an Order under the Light Railways Act, 1896, to be laid in the public streets, and which is not distinguishable in other respects from an ordinary electric tramway, is entitled to special treatment by the rating authority. Thus it is assessable to the general district rate as land "used only as a railway constructed under the powers of any Act of Parliament for public conveyance" within the meaning of Sec. 211 (1) (*b*) of the Public Health Act, 1875, in the proportion of one-fourth part only of the net annual value thereof. The phrase "used only as a railway," refers to a user by the occupier who is to be rated. It is possible that this clear statement of the law has been made rather too late in the history of electric tramway enterprise, because most of the districts in which electric locomotion was a matter of urgent necessity have already been exploited. It is impossible for those who are proprietors of an electric tramway to so alter their undertaking that the rating authorities will treat it as a light railway. At the same time, it may be useful for those who contemplate applying for powers in respect of districts not yet developed, to remember that a heavy saving in rates may be effected if advantage is taken of the Light Railways Act, 1896.

The Commercial Conditions of Electric Railway Construction.

THE question as to the remunerativeness of electric railways, with special reference to the various schemes brought forward in the German capital, has formed the subject of an interview with Herr Paul Wittig, manager of the Berlin Elevated and Underground Electric Railway Co. At the outset the manager stated that no fixed rules can be given for the calculation of the commercial prospects of high-speed lines for Berlin, as so many individual circumstances come into play in judging the economic probabilities, and as only a full knowledge of the special conditions, in view of the uncertainties of traffic, can lead to a conclusion so as to estimate beforehand with some certainty the results in any particular case. It is often difficult to discover, even in the working of the sections of the Berlin company's railway, the causes of unexpected fluctuations which take place in the traffic, and thus it is all the less possible to make computations in advance in respect of a definite scheme. Traffic emanates from various sources and is so dependent upon subsidiary influences that what is of value in the case of one railway may turn out to be quite different in regard to another, notwithstanding the apparent analogies between the two lines. The latest events in London, in the opinion of the manager, show what disillusions can arise even where the railways serve the densely populated parts of the city. Nevertheless, the experience hitherto gained allows of certain economic deductions being drawn. For instance, traffic alone does not determine the remunerativeness of high-speed electric railways, but the amount of the cost of construction and the passenger fares also come into consideration. The latter have their natural limit and, as a consequence, the other two factors come principally into question. A very natural rule would be to assume that a railway built in the densely-populated inner city could bear a large expenditure on establishment, but that the cost of both construction and working must be lower in districts having a smaller population. It thus follows that costly underground electric railways should only be constructed under the former conditions, leaving other systems for use in other areas. Elevated railways could be utilised in the centre of wide thoroughfares, and it would also be partial to exclude the suspended electric railway method from participating in the traffic of large cities. Each system has its justification, and there are probably routes in which the suspended principle could be advantageously used. But, in the interest of the development of high-speed city traffic, unremunerative lines should not be allowed to come into existence, as the inevitable result would be, Herr Wittig concludes, that the development of fast lines would wholly come to a standstill, as in London.

The Danger of Knowing a Little.—The following extract from a circular issued by a firm of oil manufacturers (one of whose directors is a M.I.E.E.) will amuse our readers:—

"It has come to our knowledge that carbonisation has occurred in the couplings of turbines to such an extent as to impair their freedom, and although this may seem an impossibility (the coupling being removed from any excessive heat), yet we venture to think that the explanation may be found in the passage of electric current through the coupling.

"It is a well-known fact, entirely apart from possible leakage, a mass of metal revolving in a magnetic field will have current induced in it, and although the voltage may not be very high, yet with intermittent contact, such as no doubt occurs in a coupling (especially if there is any vibration) the small sparks or arcs set up would be sufficient to start decomposition, and this having been started, it is only a matter of time for the coupling to become entirely choked. It is, perhaps, curious that the coupling bearing is the one where the effect is most noticed, but on consideration it will be seen that the coupling offers the easiest passage to earth, the current passing right through the spindle of the turbine centre. Metallic contact is formed through some of the auxiliary gear to earth. Of course, a very obvious suggestion to test this theory is to earth the generator shaft at the outer end and see if the decomposition stops, and this is now being tried."

American View of German Contracting.—They manage some things differently in Germany, and it is doubtful whether an American electrical contractor would be happy under the inspection condition prevailing in Berlin. Indeed, it is possible that those to the manner born do not thoroughly enjoy them; but the Berlin inspector is a government official, and protest is vain under a ruling system which holds to the old-fashioned theory that the comfort and safety of the public are proper subjects for governmental solicitude. In Berlin then, the wiring hazard is taken very seriously by the authorities, and they have an effective way of dealing with the absent-minded contractor; his licence is promptly revoked, and for the rest of his life he can saw wood, if he likes, but he must not handle wire. Their method of catching him is simple and pretty sure. The visits of the inspector are irregular and always unexpected; the day or hour of his coming is never known in advance; he hovers like an invisible cloud-burst over the head of the apprehensive contractors at all hours of the day and on every day of the week. The sword of Damocles was not a circumstance to this uniformed, spectacled, and most formidable Berlin inspector. And when he falls, he comes down on the hapless contractor with genuine Teutonic weight. "Gott in himmel!" he roars to the trembling contractor, "why that cord have you put up, and that wire you bush it not through already!"—and there is one electrical contractor the less in the good city of Berlin. Yes, they manage these things differently in Germany.—*Electrocraft.*

THE PROTECTION OF ELECTRIC MOTORS AND APPARATUS AGAINST FIRE-DAMP.

[BY OUR BERLIN CORRESPONDENT.]

THE most serious drawback to a more general adoption of electro-motors in coal mines, has been the danger of fire-damp and coal-dust explosions, due to the unavoidable sparking.

Endeavours have been made to eliminate this danger by using motors of the perfectly enclosed type; but as an absolutely air-tight carcase could not be obtained, the motor

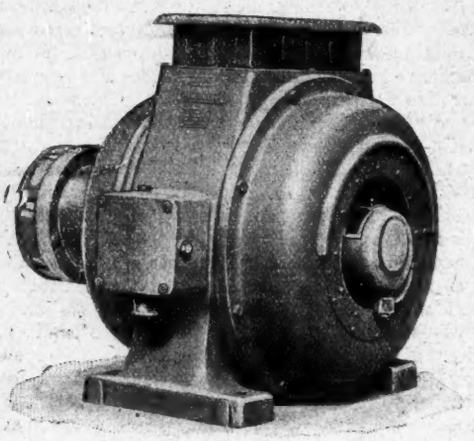


FIG. 1.

was liable in course of time to become filled with fire-damp, which, in the case of any sparking, might cause an explosion with disastrous results. Recent experiments have shown that perfect safety against fire-damp explosions can be obtained in connection with both motors and apparatus, by following a principle similar to that of the familiar Davy safety lamp. The Felten-Guilleaume Lahmeyer Works, in carrying out these experiments, found a "plate guard" to be the most reliable. This is made up of a considerable number of sheet-metal rings or frames, placed above one another, with only small intervals. Any fire-damp ignited in the interior of the motor can escape through the slots thus formed, and while being divided up into narrow streams will undergo on the surface of the sheet metal such a considerable cooling as to

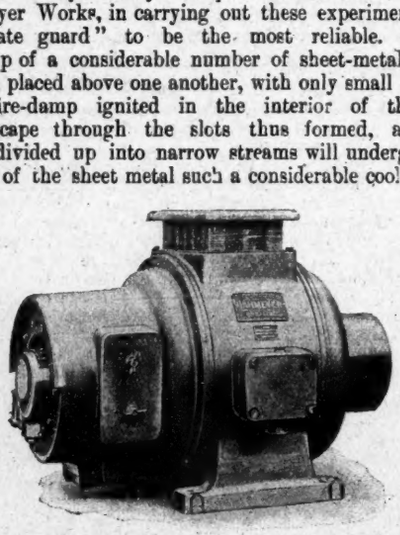


FIG. 2.

prevent its igniting any gases situated outside of the motor.

The principle above referred to has been utilised in constructing a motor proof against fire-damp, as represented in the accompanying figures :—

Fig. 1 shows an alternating-current motor, of considerable output, with a short-circuited armature, the plate guard for the stator coils being fitted to the upper part of the frame, whose shape has been adapted to this purpose. The guard comprises a number of sheet metal frames placed one above another, as just described, while the rotor being enclosed by two similar devices, located in the bearing brackets, is likewise proof against any explosion. The remaining parts of the motor are entirely enclosed. The three conductors supplying energy to the motor enter through a connection box (fig. 1) fitted

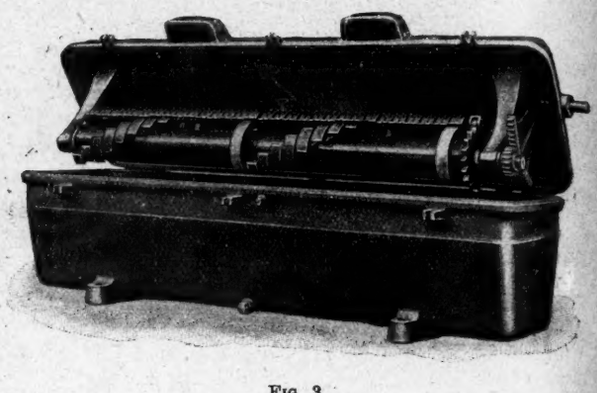


FIG. 3.

sideways to the carcase, and which, after placing the wires into position, is filled with sealing material.

An alternating-current motor of 50 H P. continuous output with 1,000 volts pressure at 975 R.P.M., designed according to the above principles, was recently tested in a special experimental shaft at the Framerie (Belgium) mines, in the presence of local authorities. The experimental tank, having been filled with explosive gases, holding mine gas (methane) to the extent of 6 per cent., 8 per cent., and 10 per cent. respectively (fire-damp holding 7 per cent. to 8 per cent. methane, being the most easily ignited, while the violence of explosion reaches a maximum at about 9·5 per cent.), the gases penetrating into the interior of the motor were exploded by means of induction sparks, but in no case ignited any gases outside of the motor.

In the case of gun-cotton, placed in the interior of the motor, and exploded by electric sparks, explosions were likewise found to be limited to the interior of the motor, without causing any damage to the latter.

A similar enclosed alternating-current motor, with slip-ring armature, is represented in fig. 2, the construction of the plate guard being the same as in the motor just described. In order to allow the slip-rings to

FIG. 4.

be adjusted whenever required, an aperture with a threaded lid fitted tightly to it, is provided in an extension of the bearing bracket. The motor shown in the figure has a normal output of 15 H P., with 190 volts pressure at 720 R.P.M.

As motors of this kind, while being safe against fire-damp explosions, are only partly enclosed, ventilators are fitted on the shaft, which draw air through the annular "plate guard" arranged on the bearing bracket, and force it out again through the "plate guard" arranged in the housing, after guiding it around the coils. This ventilating device ensured an efficiency only about 25 per cent. less than that of the open-type motors.

In order to deal with the coal dust and other impurities which are very plentiful in mines, careful cleaning of the plate guard is required from time to time. To this effect the plate guard can be withdrawn integrally, after loosening a few screws, thus greatly facilitating any cleaning, which can be effected even by inexperienced workmen. Guards of a similar design are used in connection with such direct-current motors as should be protected against fire-damp explosions.

A set of half-enclosed motors, with slip-rings, has been recently constructed for the Olsnitz Mining Co. All these motors were wound for a working pressure of 500 volts, and 1,000 R.P.M., their output varying between 8 and 12 H.P. In connection with these motors, only two bearing brackets were provided with the plate guard, the housing itself being entirely enclosed.

The air is thus drawn in from only one of the bearing brackets, escaping after traversing the interior of the motor.

As regards the starters of such motors, which are mostly installed in close proximity, these should also be similarly protected. The starter or controller contacts are therefore immersed in oil, and in order to allow this apparatus to be readily superintended, a special type of oil controller has been developed, which has been found very suitable.

As seen from fig. 3, the controller barrel is fixed to the lid, and upon lifting the latter, is removed from the oil, so as to allow any contacts to be readily inspected. In the case of continuous current, oil controllers will be found less suitable, as the continuous-current arc produced in switching is not extinguished under oil with the same certainty as the alternating-current arc.

For a similar reason the oil, in the case of continuous operation, is liable to become decomposed far sooner, owing to the burnt particles. The use of controllers provided with a similar plate guard, is therefore preferred in connection with continuous-current motors. Fig. 4 shows the construction of such controllers, which, by the way, can be equally well used in connection with alternating current, being especially available for small outputs.

NEW CABLE-TRANSPORT CARRIAGE.

A SPECIAL carriage for heavy cable drums has recently been patented in Germany, and is illustrated herewith. It is intended only for ordinary transportation on streets, and its capacity is limited to 5,000 kg. For places with uneven roads, &c., provision is made to employ horses for pulling it, and a hand-brake can be fitted.

The frame of the vehicle is horse-shoe shaped, the open end of which can be closed with a special cross-bar. The front wheel is of smaller diameter than the two in the rear, and can be swung round by means of a pole for hand use or horses. The wheels are of cast-steel and in one piece; the axles are of hardened steel and run in bronze bearings. The load of the drums to be carried is distributed in such a manner that the three wheels receive almost equal weights. As the vehicle is without a bottom, the drums can be taken off at any desired place.

To move the drums from and to the wagon, two vertical posts are riveted upon the frame, and strengthened by diagonal struts. Each post consists of two parts, with a number of holes, by means of which and a lever the drums can be lifted up inch by inch, as shown in the illustrations. The maximum weight of a drum is 4,500 kg., and the greatest diameter 2·5 m. Owing to the long levers, which can be lengthened by steel tubes, but little power is required, and generally three men are sufficient to lift a heavy drum, two working at each end of a lever, and the third changing the bolts in the holes. If more men are at hand, lifting can be done at both sides of the vehicle at once, and the work is done within a few minutes.

Fastened to the frame below the posts are pulleys which prevent contact of the drum with the frame, so that the drum can rotate while still on the vehicle, and friction is avoided. Winding-off the cables can be done whilst standing still, as well as during motion. In order to fix the drums when necessary clamps are provided, which can be screwed towards the drum from each side of the fork-shaped frame. The width of the latter inside is 145 cm., sufficient for very large drums.

Owing to the varying weight of the drums and bore of the centre hole, two steel axles are furnished for every vehicle of 75 and 68 mm. diameter. They alone take up the weight of the drum. If the latter is to be loaded on the car the cross-connection at the rear end, described above, is taken off, and the drum and vehicle are moved towards each other until the fork of the frame surrounds the drum. Then the connection is put into place again and fastened at the corners, the steel spindle is put through the holes and the levers are moved up and down. The cross-bar is very important, and must be rigidly fastened, as otherwise the considerable weight of the drum would distort the car frame. Generally it is sufficient to lift the load until a clearance of 6 in. is reached between the pavement and the lower edge of drum.

Fig. 1 shows the drum outside and the vehicle opened at the rear to receive it. Fig. 2 shows the drum suspended freely upon the

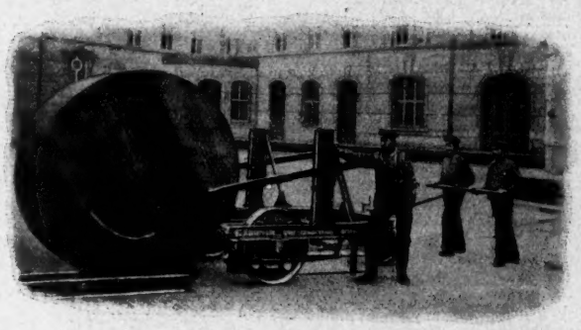


FIG. 1.

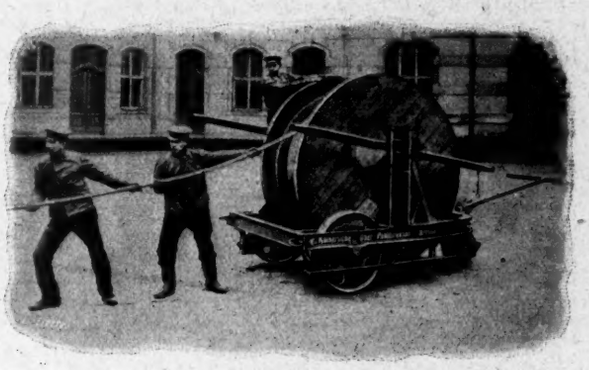


FIG. 2.

spindle, with the clamps screwed back. The sides of the drum are in contact with the pulleys within the frame, to avoid unnecessary resistance by friction, and the cross-piece is securely fastened to the frame. In such a position the cable can be wound off. The wheels are locked by a hand brake.

The holes in the vertical posts are numbered successively, to secure uniform lifting on both sides of the drum. These vehicles were first tried during the extensive cable-laying in charge of the Post Office authorities at Breslau, where they proved very successful. They were then used by other postal authorities and electrical firms. The construction of the new cars is patented.

LEGAL.

POSTMASTER-GENERAL *v.* NATIONAL TELEPHONE CO.

IN the Court of Appeal, consisting of the Master of the Rolls and Lords Justices Moulton and Buckley on Wednesday, May 27th, judgment was given in this case on the defendants' appeal from a decision of MR. Justice Swinfen Eady in the Chancery Division. The case raised a question of great importance as to the extent of the monopoly enjoyed by the Postmaster-General under the Telegraph Act, 1869. Sec. 4 of the Act of 1869 provided that the Postmaster-General should have the exclusive privilege of transmitting telegrams within the United Kingdom, but certain descriptions of telegrams were excepted by Section 5. By that section the exceptions were telegrams in respect of which no charge was made and transmitted by a telegraph, maintained or used solely for private use and relating to the business or private affairs of the owner thereof, and secondly, telegrams transmitted by a telegraph maintained for the private use of a corporation, company or person, and in respect of which, or of the collection, receipt and transmission or delivery of which, no money or valuable consideration shall be or be promised to be made or given. The National Telephone Co. hold a licence for 31 years from January 1st, 1881, granted in 1884 by the then Postmaster-General to work and use telegraphs, of which the transmitting and receiving instruments are to be telephones for the purpose of enabling

persons to communicate with one another by means of spoken words, and a royalty of 10 per cent. is payable to the Post Office on sums received. A portion of the defendants' business was the supply and maintenance for annual payments of telephonic lines and instruments constructed between two places, so as to afford communication between those two places alone. Although these lines are maintained by the defendants, they are worked and used without the intervention of any of their servants. In the special case which had been stated, instances were given of lines between different places of business where allied trades or businesses were carried on—namely, connecting fire brigade stations and other buildings, and lines connecting a theatrical ticket agency with theatres and a number of hotels. In each case the agreement of the defendants was executed, and the rent paid, by one only of the two parties so connected by the defendants' line. The first question for the Court to decide was whether the defendants in respect of those lines were liable for the royalties under their licence, or whether the telephones in question did not fall within the first exception to the Postmaster-General's privilege, since "owner" or person paying for the line was not maintaining it solely for private use for messages, relating solely to his business or private affairs. The second question was whether the defendants, by supplying and maintaining lines and apparatus for the fire alarm system by means of boxes placed in the streets, so as to enable anyone to communicate with the fire station, were concerned in transmitting telegrams in contravention of the plaintiff's privilege under the Act of 1869. Mr. Justice Swinfen Eady answered both questions in the affirmative, and the defendants now appealed.

The Master of the Rolls, in giving judgment, said that the principal question in the appeal was as to the extent of the exceptions of the Postmaster-General. The first exception was as follows:—"Telegrams in respect of the transmission of which no charge was made, transmitted by a telegraph maintained or used solely for private use, and relating to the business or private affairs of the owner." The second exception was:—"Telegrams transmitted by a telegraph maintained for the private use of a corporation, company or person, and in respect of which, or the collection, receipt and transmission, or delivery of which no money or valuable consideration shall be or be promised to be made or given." These exceptions resembled each other so closely that it was not easy to put a case of a message which could fall within the first exception and which would not fall within the second. The only distinction he could suggest was that the first might relate to the case in which a person who was owner of the telegraph also maintained it, and the second might include the case where the telegraph was maintained by a person who was not the owner. It was contended by the appellants that telephonic lines between two places for affording communication between A at one end and B at the other end, which were erected and maintained by the appellants but were worked and used independently of and without the intervention of any servants of the appellants, were within one or both of these exceptions. Mr. Justice Swinfen Eady had rejected that contention, basing his judgment mainly on the words "solely for private use," which he held to mean solely for the private use of the owner of the telegraph, including in the term "owner" his family and his employés. But the words "solely for private use" were not found in the second exception, and his Lordship doubted if "solely" could fairly be read as applying also to the words "relating to the business or private affairs of the owner thereof." The second exception seemed to him to meet the present case. The telegraph was maintained by the appellants for the private use of their customer, and no money was paid for the transmission of telegrams by means of the telegraph. The "private" use of the customer extended to the case where he wanted to communicate with the person at the other end of the wire, whether that person was his partner or employé, or his banker or broker. He thought that what had been described as an A to B private wire was within the exception just as much as an A to A wire. Assuming that, according to the true construction of the Act of 1869, A to B private lines were not within the Postmaster-General's monopoly, a question of great difficulty arose upon the terms of the licence granted to the appellants by deed dated November 29th, 1884, clause 2 of which seemed to describe minutely and with perfect accuracy an A to B line, but expressly to exclude an A to A line. The words in clause 7, directing the company to pay a royalty of 10 per cent., seemed to refer to clause 2, and the company, having accepted the licence in those terms, could not refuse to pay the royalties on the ground that in truth no licence was required as to A to B lines. It was admitted that from 1884 to 1897 royalties were paid on A to B lines, but that since 1897 payment had been refused by the company, though claimed by the plaintiff. He thought the parties to the deed bargained that A to B lines, whether or not within the monopoly, should be treated as being within it, and the conduct of the parties for 13 years supported that view. The result was that the defendants, in his view, were accountable to the plaintiff for royalties under clause 7 of the licence, in respect of all the classes of lines mentioned in the first schedule. As to the second question, the licence had no application, and it followed that, in his opinion, differing from Mr. Justice Swinfen Eady, the answer should be that the defendants were not acting in contravention of the exclusive privilege of the Postmaster-General, but as the other members of the Court took a different view as to the first question, the appeal would be allowed on both points.

Lord Justice Moulton said that, taking both the exceptions into consideration, he was of opinion that the Legislature intended that private telegraphs should be outside the monopoly of the Post Office to the extent that such a telegraph might be used for sending telegrams relating to the business or private affairs of the owner and that he was at liberty to deal with such telegrams when received just in the same way as he could with a message sent by himself, without the intervention of the telegraph—namely, he could pay for its collection, receipt or delivery. The exception then granted reasonably protected the use of private telegraphs belonging to or maintained for a person for his private use. If, therefore, a firm chose to establish private telegraphs to their bankers or their customers for the convenience of their business, and made no charge for the transmission, collection, receipt or delivery of any of the messages sent thereby, they appeared to him to be well within the exception. In his view, therefore, the A to B line was outside the monopoly of the Postmaster-General. He was of opinion that the agreement of November applied only to telegraphs and telegrams which required the licence of the Postmaster-General, and that it was the common intention that the telegrams which were statutorily outside his monopoly were not to be affected by it. He was also of opinion that telegraphs used only for the transmission of telegrams within the statutory exemptions—A to B lines, for instance—were outside the licence. He thought the appeal should be allowed.

Lord Justice Buckley delivered judgment to the same effect, and by a majority of the Court, therefore, the questions in the special case were answered as follows: (1) That the defendants were not accountable to the plaintiff for royalties in respect of the lines specified in schedule 1 of the special case, and, secondly, that the lines in schedule 2 were not in contravention of the Postmaster-General's licence.

The appeal was, therefore, by a majority of the Court, allowed with costs.

PARLIAMENTARY.

London and District Electric Supply Bill.

(*Continued from page* 906.)

Tuesday, May 26th.

Mr. Cane, at the opening of the proceedings, addressed the Committee on behalf of Marylebone Borough Council. He explained that the Council acquired their undertaking from the Metropolitan Electric Supply Co. That company was established in 1889 and was subjected, like all others which started pioneer work, to innumerable difficulties. However, they surmounted them all. Several times the Council came to Parliament to ask to be allowed to compete with the company, but they said "no, if they wanted to supply electricity they must acquire the undertaking." They purchased the company's property for £1,200,000. The undertaking had not only been able to pay a considerable sum towards reducing the rates, but they had put aside a reserve account to provide for contingencies, and had lowered the price of current more than ½d. per unit. He did not think it could be said that they had made a bad bargain. Parliament would not let them compete, so they had to purchase the undertaking. It was unfair that the promoters, after the Council had gained its experience and fought against difficulties, should be allowed to come in and compete. He submitted that the promoters should be treated on the basis that Parliament treated his clients. Notwithstanding the large sum paid for acquiring the company, the capital cost for the consumer whom they had to deal with—the small consumer—was actually lower, without deductions, than the price which the promoters scheduled in their Bill. The promoters said that the Council would gain if they took a supply from them. He absolutely disputed that so far as the area and kind of customers was concerned. Let them place generating cost against generating cost. The Council when they generated their energy, placed it straight on the switchboard. The promoters had to bring it from Barking, and they had admitted that they would have to generate 10 kw. for every 9 kw. required in London. The witnesses for the promoters had said that his client's undertaking was a meagre and miserable one; in that case why were they so anxious to include Marylebone in their area?

The Chairman: The Committee's minds are quite open, but I should like to ask you this, in dealing with competition, whether the Kitson Clause or the clause which has taken its place in the Bill, is the most favourable to the Borough Councils?

Counsel: The Kitson Clause certainly gives us a certain measure of protection.

The case was then opened for the West Ham Corporation. Mr. A. H. Seabrook, electrical engineer to the Corporation, was the first witness called, and stated that they commenced a supply in 1898. The work was purely for lighting when they started. They had constructed a new station at Tuckers Street, Canning Town. The site was capable of accommodating 100,000 kw.

In reply to the Chairman, Witness said that the capital expenditure had been £340,000.

Continuing, Mr. Seabrook said that since the new station had been erected the demand had increased, especially within the last three years. In 1904 the total output was approximately 2¼ million units, whilst at March 31st, 1908, the number of units generated was 11¼ millions. The output for power purposes was, in 1904, 212,000 units, and in 1908 it had increased to 4,000,000 units. The demand for power was increasing. One-fourth of their output was for lighting, and the remaining three-

fourths for power purposes. With the exception of the Newcastle Supply Co., the West Ham Corporation was supplying a larger number of units for power than any other company operating in the country. They had just entered into a contract with a consumer for five years, whose yearly demand would be greater than the output of the Yorkshire Power Co. They supplied current for power at 1d. per unit with deductions according to the load factor, and it worked out at an average price of ¾d. per unit, and the charge for lighting was 3d. per unit. Since 1901 they had also equipped factories, &c., with electrical plant.

The CHAIRMAN: Do you say your works are capable of extension?—WITNESS: Very large extension.

Continuing, MR. SEABROOK said that the total number of kilowatts supplied to consumers of over 250 KW. was, roughly, one-third of the total output.

MR. CLODE asked witness whether he would prefer the Kitson Clause or that now in the Bill.

The CHAIRMAN, interposing, said that he did not think counsel should press witness to answer the question.

MR. H. R. BLAIN, tramway manager, gave evidence, and contended that if the Bill passed, the laying down of the mains, &c., would seriously interfere with the tramways.

MR. MORTON then addressed the Committee on behalf of the Corporation. He contended that the promoters had not treated them on their merits. They had included them in a large area without regard to the Corporation's particular claims. No doubt the deductions drawn by the promoters might be applicable to the whole district, but they did not apply to their area. They wanted to be treated on their own merits. They had borrowed £400,000 under the powers of their Act. He had no doubt the promoters would like to get them within their area, but he thought it would spell disaster to his clients. They did not want the company at all. He objected strongly to the clause in the Bill inserted in the place of the Kitson Clause.

Hampstead Borough Council then stated their objections.

MR. CHARTRIS said that the Council obtained powers in 1892 to supply electricity, and commenced to supply in 1894. The total capital borrowed since the establishment of the undertaking was £383,000, out of which £83,000 had already been paid off. In 1903 it occurred to the Council that the original period for the repayment of the loans—42 years—was too long, and the Borough Council in that year approached the County Council and suggested that the period for repayment should be reduced to 25 years, and the Council had been repaying their loan on that basis. Despite that burden they had gradually reduced the price of current. In 1905 it was 2d. per unit for power, and since then it had been reduced by 100 per cent., and the average price was now 1d. per unit, which was the price given in evidence by the witness from the Yorkshire Power Co.

The CHAIRMAN: I see you have a small power supply.—COUNSEL: Very small indeed.

Continuing, MR. CHARTRIS said that in addition to the foregoing, they had been able to set aside a reserve fund for depreciation and renewals which was far in excess of that of any other Borough Council. They had also been able to reduce the rate by ½d., having set aside £1,000 a year to the relief of the rates. So far as the future of the undertaking was concerned they viewed with apprehension the proposals made by the promoters. In Mr. Merz's Bill, Hampstead was included in the non-industrial area, but the Committee struck them out altogether and put them in the Metropolitan Supply Co.'s area. They had, therefore, the option of taking a bulk supply from that company, and no other company could come in and compete with them. The promoters asked to go into an area which was already supplied by two authorised distributors, under totally different terms to those possessed by the existing distributors. The only reason that had been put forward why the company should go into that area was because the least harm would be done to them.

The CHAIRMAN: Have you any consumers over 250 KW. ?—COUNSEL: No, my Lord.

Continuing, COUNSEL said that the Council believed that if the Bill passed it would seriously jeopardise the power supply business of the Council.

MR. W. L. WILLIAMS having addressed the Committee on behalf of the Stepney Borough Council urging that his clients should be omitted from the area of the Bill, the Committee adjourned.

WEDNESDAY, MAY 27TH.

MR. W. C. P. TAPPER, electrical engineer to the Stepney Borough Council, said that, in his opinion, the clause in the Bill which enabled the promoters to give 20 per cent. of the total amount of energy required by a consumer for lighting, would act as a serious competitor with the Council. Even if they combined and took a bulk supply from the promoters, they would have to sell at a loss to keep out the competition of the company.

Replying to the CHAIRMAN, WITNESS said they hoped to get a demand for power purposes.

MR. COURTHORPE MUNROE addressed the Committee on behalf of the St. Pancras and Shoreditch Borough Councils, and stated that he would confine his remarks to competition. He would call engineers from both boroughs to show that they hoped to get a bulk supply in time, at better and cheaper rates than the promoters now said they could supply at. The whole of his argument was that the proposals of the promoters constituted unfair competition with the local authorities. Dealing with St. Pancras, counsel said that that borough was the pioneer borough to start electric supply. They got their order in 1883 and began to supply in 1891, and there was some half-a-million of money invested. Their concern had done well, and they had been able to relieve the rates to a considerable extent. When Mr. MERZ's Bill was introduced into Parliament, St. Pancras offered to supply the public at his prices. The local authority supplied 80 per cent. or four-fifths of those who were using energy in the borough. Last year they generated four million units for lighting and 1½ million units for power and heating. They had direct current, and the average load factor was 20 per cent. As regarded Shoreditch, they got their order in 1892 and started to supply in 1897, and something like one-third of a million was invested in the concern. They supplied two-thirds of the energy required in the district. The consumers were small—they had not one consumer who was taking over 200 KW.; the average was 5 KW., and the load factor was 15 per cent. The Shoreditch Borough Council generated 4¾ million units for lighting, and 2½ million units for power and heating. The promoters seemed as if they had drawn a ring round London, and because St. Pancras and Shoreditch were in the ring they said their Councils should come in the scheme. He contended that they should deal with the districts individually. Let the promoters make out their case, and if they failed they should strike St. Pancras and Shoreditch out of the Bill, and put in a measure for the protection of these two Councils a clause on the lines suggested by Croydon.

MR. S. W. BAYNES, electrical engineer to St. Pancras Borough Council, was called in support of counsel's opening statement. In answer to MR. CLODE, WITNESS said that their total income from all sources was £72,000, and of that £7,000 was for power. Their district was an industrial one. Their charge for generating cost was about 1·194d. per unit. If the Bill were to pass, the promoters would come into his district and cause dissatisfaction amongst their customers. Under no circumstances whatever would they take a supply from a bulk company.

MR. C. N. RUSSELL, electrical engineer to the Shoreditch Borough Council, said that the Council at first charged 2d. per unit for power, but that had since been reduced to what was known as Merz prices. He did not think it would pay them that day to take a supply from the promoters at their maximum prices. It might pay them that day to take a supply on the promoters' estimated prices. He said "that day," because he believed that in two or three years' time they would be in as good a position as the promoters would be, as by then their plant would be properly developed.

Cross-examined by MR. CLODE, WITNESS said that the works cost was 1·19d. per unit. Of course, if the Council were offered a supply at a cheaper rate, he believed they would, as business people, seriously consider it. His Council disapproved of the Bill altogether. They considered that the existing authorities could deal with the question.

MR. SNOWDEN addressed the Committee for the Hammersmith Borough Council. He said he should like to associate himself with what had been said by other local authorities, that the Bill constituted a real and serious competition. The promoters were asking to go into a district, and that must have a disturbing influence. It was not only disturbing as regarded the breaking up of the streets, but the promoters would be able to a certain extent to dictate what prices they should charge, and with regard to the larger consumers they would be able to enter into very formidable competition. It had been said by the company that the local authorities were working under disadvantages, but it was not so in the case of Hammersmith. Their works were capable of further extension. They supplied as much current for power as for private lighting. As an instance of how the competition would affect them, counsel said that they were supplying a total of 2,400,000 units to 176 consumers, and out of those units nearly 1,900,000 units were supplied to only 14 consumers. They calculated that they would be able to pay off the capital cost of their machinery in 18 years, and the life of that machinery was 25 years, so that when they had paid off the capital expenditure, they would be in a favourable position. They had paid £7,000 to the relief of the rates.

MR. G. G. BELL, electrical engineer to the Council, said that he had been in charge of the electrical works since 1896. In reply to questions from members of the Committee, the WITNESS gave figures to show that they were paying off their capital charges on a different basis from that reckoned by the promoters. Continuing, he said that he did not agree with the figures put forward by the promoters. He could not see how they could possibly gain by taking a bulk supply from the company. They had paid off at the end of March this year £49,000 out of a total capital expenditure of £290,000. He thought the promoters' proposals would prejudice the Council very seriously, as they would be able to take their best customers and leave them the less desirable ones.

MR. FREEMAN, K.C., on behalf of the L.C.C., then addressed the Committee. He said that they, as perhaps the ultimate purchasing authority, viewed with apprehension the Bill as it stood—it simply regarded the shareholders, and did not study the public interests. He could not criticise the area proposed to be covered by the scheme, as it was in their opinion a right one—it was the same area as they suggested. They did not criticise the site chosen for the station, and they did not criticise the engineering details, because they were to all intents and purposes the engineering details they themselves had submitted. The evidence given by the engineering witnesses was the same as given when the L.C.C. promoted their Bill. As to the question of finance, if the Committee were satisfied that the financial support of the Bill was such as would reasonably ensure the promoters getting their money within a proper time, and being able to carry out their work, they (the L.C.C.) did not desire to stand in the way in that matter. They had listened to the evidence put forward by the financial witnesses, and while it was very far short of the strength of the support behind the Administrative Bill, and

necessarily very far short of the security that could be offered by a public body, yet they did not offer any objection to it.

In reply to the CHAIRMAN, COUNSEL said the L.C.C. agreed with the maximum prices.

Continuing, MR. FREEMAN said that, in the first place, they thought there ought to be very strong provisions made in the Bill to ensure that it would not act as a block Bill to other schemes. They (the Council) wanted a very much stronger clause than Clause 75 as it stood. They wanted the section modified so that the powers should cease if the works were not substantially commenced in two years, and a considerable portion of the capital raised within one year. The Council suggested £1,000,000, and the Committee knew that the promoters proposed within a comparatively short time to raise £3,000,000, otherwise they could not pay interest out of capital. He understood that the financial supporters were ready to raise £600,000, and he was prepared to accept that as the sum to be raised within one year. Clause 62 limited the amount to be paid in dividends to 8 per cent., and provided that if the profits exceeded the amount applicable to the dividend, they might invest it in an insurance fund, such fund not to exceed one-twentieth of the capital. They were under no obligation to provide that fund, which would be used for the particular purposes for which insurance funds were raised. Clause 63 was a clause that enabled the promoters to create a reserve fund, but there was no limit whatsoever, because they would put aside such sums as they should think fit. If that fund was to be made out of the divisible profits before the promoters took their share, it would not be open to the objection it was, but as the clause stood they could create a fund as large as they liked, which he would show would act to the public detriment under certain circumstances which might arise. The next clause—64—dealt with the surplus profits, and it divided these surplus profits into three portions. One-third was to be used to form a sinking fund, another third to reducing the price of electricity, and the remaining one-third to increasing the dividend beyond the authorised rate. That clause, although he believed it had been introduced in another Bill, was an unusual clause, and in the Council's opinion, an extremely objectionable clause. There were recognised means of dealing with surplus profits between trading authorities and the public; there was what was known as a "sliding scale" clause. The whole object of that clause was that such profits made between seller and buyer should be fairly divided, and it acted as the strongest possible inducement to economical working on the part of the company. Under the clause of the promoters, however, one-third each went to the company and the consumer, and one-third went to form a sinking fund, which ultimately went to the purchaser at the end of 42 years in reduction of the purchasing price of the undertaking. What would arise under the sliding scale clause would be that the consumer would get half the share of the profits. He could not see the slightest reason why the promoters wished to hold over one-third of the profits for the benefit of posterity 42 years hence. The promoters had power to take an 8 per cent. dividend, and if it should fail in any one year they could make it up out of profits when they had a good year. They could form an insurance fund, and give themselves a reserve fund absolutely with no limits, and then they asked to devote the surplus profits in the way in which he had just mentioned, and the consumer, therefore, got very much less benefit than he would under the provisions of the sliding scale clause.

THURSDAY MAY 28TH.

MR. FREEMAN continued his address on behalf of the London County Council. He said that the difference between the promoters and his clients was mainly on the purchase clause. Counsel then dealt at length with the question of purchase, and submitted that the undertaking should be acquired under the terms of the Electric Lighting Acts—that was the "then value." Dealing with the next clause, which provided that the purchasing authority should make up the dividend to 6 per cent., counsel pointed out that that would mean that something like £3,750,000 would have to be paid if the company only paid a 4 per cent. dividend during their tenure. The promoters would agree that it would most probably act as a prohibitive clause to a purchasing authority, but he (Mr. Freeman) fancied it was put there so as to get a further length of life for the company, because if they let the promoters go on for another 10 years the question of dividend was not reckoned. He submitted that the promoters were in the position of all other commercial companies during their term of concession, and they must make the best of it. It passed his understanding why they should ask for their dividend to be made up. Why should they be held absolutely safe for a 6 per cent. dividend during the whole of their working?

In reply to the CHAIRMAN, COUNSEL said it was not the question of the figure, but the principle that he objected to.

Answering LORD WELBY, MR. FREEMAN said the clause was a new one, and was the product of the ingenuity of the promoters.

MR. FITZGERALD remarked that there had been 20 Power Bills passed, and not one of them had a purchase clause.

MR. FREEMAN, continuing, said that if Clause 65 contained the words that "the undertaking should be liable to purchase by any County Council, or joint committee of County Councils, body of trustees, or other public authority or body who may be authorised by Parliament to purchase the undertaking," &c., Parliament had on many occasions said that they thought that the L.C.C. was the right authority to acquire such undertakings, and he would, therefore, suggest that the words "London County Council or any other public body," &c., should be inserted. They did not want to put themselves forward, but they considered that somebody should be definitely named, so that at the appointed time that body could look after the public interests. The County Council were also of opinion that when the time came for purchasing the undertaking following the precedent of the Metropolitan Water Board, it should not necessarily be bought for cash, but in stocks if thought necessary.

Replying to the CHAIRMAN, MR. FREEMAN said that he did not mean it to be obligatory but optional, such option to be at the discretion of the purchasing authority.

Referring to the Kitson Clause, COUNSEL said that that clause was first raised in 1900, but it was practically thrown over in the Bill introduced by the promoters. The clause inserted by the company had met with opposition from the local authorities, and the L.C.C. did not appreciate it. They could not see what case had been made out for the company to supply large consumers without any reference to the wishes of the local authority in whose district the consumer was. There was no reason why because a man happened to have a supply over the 250 KW. the promoters should have power to supply without consulting the views of the local authority. Another part of the Bill which was unreasonable, was that the company should have the power to supply a consumer if the local authority did not supply him a certain percentage, because he did not use 250 KW. or more. The promoters seemed as if they had not taken into consideration the individual circumstances of the authorised distributors. The Council considered that if a company or a local authority got their electricity at a reasonable price, that there ought to be some provision at the end of the Kitson Clause, so that the consumer got his current at a reasonable rate. A consumer also should have the right to appeal to the Board of Trade, and demand a cheap supply if he knew that the company from whom he was getting his current was getting it at a cheap rate. Really the views of the L.C.C. were that the Kitson Clause with certain improvements which he had endeavoured to indicate, should be used in place of the promoters' clause.

The CHAIRMAN: My general impression is that the L.C.C. recognise the advantage of a bulk supply, and, therefore, under certain conditions they are not prepared to oppose that proposal. MR. FREEMAN: That is so.

Continuing, COUNSEL said that they had endeavoured not to make any suggestions which would wreck the Bill—they thought they were not asking anything which would affect the raising of the capital—all they asked for was protection.

MR. FELIX CASSELL, K.C., Chairman of the Parliamentary Committee of the L.C.C., was called in support of counsel's statement. In answer to the CHAIRMAN, he said that why the Council wished to be inserted in the Bill as the probable purchaser, was that when the appointed time came they would not have to go to Parliament to ask for purchasing powers. Continuing, WITNESS said he thought that some opportunity should be given, so that the undertaking could be acquired in 1931. In that year the tenure of the electric lighting companies came to an end, and it might be thought desirable to place the lighting and power business under one control. As to the purchase clause, they did not agree with it as it stood. The purchasing authority 42 years hence might have to pay for new inventions which occurred during the tenure of the company. As an instance of what might happen, Mr. Cassell said that the County Council still had standing against their capital expenditure the cost of a horse tramway track which had since been electrified, whereas, of course, the horse track was not now in existence.

Replying to the CHAIRMAN, WITNESS said that they did not object to the rate of dividend proposed to be paid.

In cross-examination, MR. CASSELL said that the Council recognised that the question was one of urgency. They had no objection to the Bill passing this session, so long as the interests of the public were safeguarded, and the rights of existing distributors protected.

MR. HAWARD, comptroller to the Council, said he thought that the basis on which the undertaking was to be acquired was unsatisfactory. He did not think that the purchase clause dealt sufficiently with the question of the obsoleteness of the plant. He saw no difficulty in applying the Electric Lighting Acts as the terms of purchase. He did not think it would interfere with the raising of the capital, as something like £40,000,000 had been subscribed for under those Acts. As to the uncertainty of the Act, he thought that could easily be met by the forming of a sinking fund. If they placed 21s. per cent. by every year for the 42 years, they would have the whole of their capital at the end of the concession. Supposing they did not put anything aside during the first 12 years of their working, if they then put aside 38s. per cent., they would get their capital back. He attached very great importance to the purchase being made either in cash or stocks at the option of the purchasing authority.

FRIDAY, MAY 29TH.

At the opening of the proceedings, MR. ERSKINE POLLOCK, K.C., addressed the Committee on behalf of the Middlesex County Council. He said that the districts which the promoters proposed to supply in Middlesex were Acton, Ealing, Hendon, Willesden, Wood Green, Chiswick, Enfield, Friern Barnet, Edmonton, Southgate, and Finchley. The counsel contended that they should never have been put in the area, and they asked to be struck out. Their position was emphasised by the purchase clause, and secondly, the form which that clause would take if the suggestions of the L.C.C. were accepted. The Parliamentary Committee had passed a resolution, which had since been confirmed by the whole body of the Council, protesting against being included in the area, and stating that if a company should be entrusted with the power of the bulk supply they (the Council) should have the power to purchase at the end of 30 years. He submitted that no *prima facie* case had been made out why Middlesex should not be kept entirely separate from

London? If the suggestion of the L.C.C. was accepted they (the L.C.C.) might be the purchasing authority, and Middlesex viewed that with apprehension. If the L.C.C. was not the purchasing authority, it might be a compound body of one or more councils, and that the Middlesex Council considered would lead to endless confusion. If the L.C.C. was the purchasing authority the question would arise as to who was to bear the loss, if any, that occurred on the working, as Middlesex was not included in the area covered by the London County rate. On the other hand, if a profit was made why should Middlesex be exploited for the benefit of the ratepayers of London? Therefore he submitted that unless a strong case was made out for Middlesex to be included in the area, it should be struck out, as otherwise it would lead to endless friction and confusion between the two Councils. He contended that the witnesses for the promoters had agreed with his argument, as they had said when he asked why they did not include Wembley in their area, that they must stop somewhere. Why, therefore, did they want to include Middlesex? The Council already had in their area the North Metropolitan Co. and the Metropolitan Electric Supply Co., who were well able to give them a bulk supply. He contended that the scheme did not stand or fall by the inclusion of Middlesex, although of course he was aware that the promoters were desirous of including them. Parliament had never allowed the companies to compete for a bulk supply. The limit of economy had been exceeded, as it had been decided that 15 miles was the limit, whereas the promoters proposed to go 18 miles. He maintained that as Middlesex was a growing county, it ought not to be interfered with, as in the future it might be desirable to deal with the county as a whole.

The CHAIRMAN: Do I understand that any of the other Councils —Kent, Surrey or Essex are represented here by counsel?

MR. CLODE: I don't think so, my Lord.

MR. JAMES BIGWOOD, Chairman of the Parliamentary Committee, said that the Middlesex County Council had over 20 miles of tramways running in the County and several miles were under construction. The trams were leased to a company as the Council did not agree with municipal trading, but believed in the efficacy of county control. There were no purchasing powers in the Bills of the North Metropolitan and the Metropolitan Companies. As regarded the proposals of the promoters, they thought they either went too far or not far enough—they left parts of Middlesex out. What the Council wanted was "all or none." They would not object if Parliament sought fit to appoint an authority to supply the whole of Middlesex.

Replying to MR. CLODE, WITNESS said he was aware that the promoters had extended the acreage by 20,093 acres in Middlesex over that of the London County Council Bill. He did not think that there was anything in the Bill which prevented the promoters from giving a supply to the companies that were supplying the Council. He admitted that the companies from whom they took their supply did not confine their area to Middlesex but spread all over London and in Essex.

MONDAY, JUNE 1ST.

MR. BLENNERHASSETT, K.C., addressed the Committee on behalf of the Westminster City Council, which authority, he said, had no electrical undertaking of its own. It had several companies supplying within its area. The rateable value of the City was £6,000,000. As the Committee knew, the local authorities had the right in 1931, of purchasing all companies supplying electricity in their district, and the Council looked upon that as a valuable asset. He contended that the circumstances of Westminster were exceptional—they would be able to purchase undertakings, and they could also purchase generating stations at Marylebone, and he maintained that their existing rights as accorded them by the present laws should not be interfered with. He considered that the effect of the Bill was to tie the hands of the authorised distributors behind their backs, and give an unfair advantage to the promoters. His clients objected most strongly to Clause 52, which enabled the company to come in and compete with them to supply small customers if the authorised distributors did not supply them at a certain rate. Such a clause was without precedent, and would act most unfairly against the authorised distributors. He would rather have the Kitson Clause of the two clauses, but really he objected to both of them. He submitted that the promoters should not supply consumers apart from railways, canals, &c., without the consent of the local authority. He asked that they should be treated as it was proposed they would be under the Administrative Bill. The Council also objected to Clause 73 which gave the promoters power to acquire authorised distributors' undertakings subject to the approval of the Board of Trade. What would be the effect of that—the District Co. could go behind the backs of the local authority and purchase an undertaking, and the promoters could then charge the prices that the purchased company was entitled to demand. What his Council wanted was that the promoters should not be able to buy an authorised undertaking without the consent of the municipal body. From the evidence of the promoters' witnesses no injury would be done to the scheme, as a whole, if they were to safeguard the local authorities as he had suggested.

In reply to the CHAIRMAN, COUNSEL said he wanted his rights of purchase in 1931 preserved intact. His argument was based on Sec. 2 of the Electric Lighting Act of 1888.

MR. P. PILDITCH (chairman of the Law and Parliamentary Committee), was called in support of counsel's statement, and said that there were seven companies supplying within the Council's area. They had no objection to a bulk supply for London, whether on the lines suggested by the promoters' Bill, or the amalgamating of the existing companies—all they wanted was to preserve their rights of purchase.

MR. J. HUNT, town clerk, also gave evidence corroborating the previous witnesses. He did not know that the capital required to purchase the present companies supplying in the area would amount to about £2,000,000.

In re-examination, WITNESS said that they would like to have the absolute right of refusal to allow the promoters to acquire undertakings in their area. If, however, they could not get that they would be willing to accept the Board of Trade for a final appeal.

MR. SAUNDERS, on behalf of the Islington Borough Council, next addressed the Committee, and pointed out the strong objection they had to a company coming in and taking away the power consumers, who were their most profitable customers. The Islington Borough Council had spent £459,000 on their electricity undertaking, and last year 5,000,000 units were generated. They believed if they were allowed to go on that they would be able to generate electricity more cheaply than the promoters. Of the 317 power consumers in Islington, his clients were supplying 206. If his power customers were taken away his electric lighting undertaking could not possibly pay.

MR. A. GAY, electrical engineer for the Islington Borough Council, said that if his Council put in plant up to 40,000 KW., the average on the total capital expenditure of the whole undertaking (which would then be £900,000) would work out at £22 10s. per KW. This, he considered, compared very favourably with the figure put in by the promoters. If they had never had any street lighting at all they would still have made a small profit on their undertaking. They looked on the power supply part of their business as a by-product, and judging it from that point of view it was profitable.

Cross-examined by MR. CLODE, WITNESS said they derived £5,000 of their total income of £52,000 from the supply of power. The total cost per unit for 1907-8 was 2·52d., while in the previous year it was 2·86d.

MR. READER HARRIS proceeded to address the Committee on behalf of the Borough of Ealing and the Urban District Council of Barnes, both of which districts he said were residential. They asked to be excluded from the Bill, except so far as clauses might be inserted giving wayleaves to the promoters.

Damage to Submarine Cables.—In Friday's Parliamentary Papers Mr. Boland asks the Vice-President of the Department of Agriculture for Ireland whether his attention has been called to the published statement of the diplomatic representations made by the United States Government on the subject of the breaking of the submarine cables off the coast of Kerry by trawlers; whether he is aware that these trawlers carry on operations within the prohibited limits, and, in addition to the damage done to the cables, have inflicted serious loss on the local fishermen; and whether, with a view to safeguarding the interests of the fishermen and of the cable companies, nine of whose cables are laid in a space of 1½ miles in Ballinskelligs Bay, he will endeavour to secure protection from the operations of these trawlers in this district. Mr. T. W. Russell replies that the alleged damage to submarine cables by steam trawlers has been brought under the notice of the Department. The protection of cables is not the direct work of the Department, who have, however, taken all steps that are reasonably possible to secure the due observance of their fishery by-laws.

Leeds Corporation Bill.—The preamble of this Bill was on Wednesday last week declared proved by the House of Lords' Committee on Unopposed Bills. Under the Bill it is sought to construct tramways in the urban districts of Horsforth, Rawdon, Yeadon and Guiseley, and to transfer the powers under the Pudsey Corporation Tramways Order, 1905, to the Leeds Corporation. Borrowing powers are taken for tramway purposes to the extent of £105,000.

Great Northern, Piccadilly and Brompton Railway Bill.—The above Bill was before Lord Onslow's Committee of the House of Lords on Unopposed Bills on Wednesday, May 27th, and was ordered to be reported for third reading. The Bill contains important provisions with regard to the rearrangement of the existing capital. It abrogates an existing agreement between the Underground Electric Railways Co. and Messrs. Speyer and the company, and authorises the conversion of the existing shares into preference shares.

Stockport Corporation Bill.—On May 27th the House of Lords' Committee on Unopposed Bills passed the preamble of the above measure, which contains a proposal to construct a tramway in the parish and rural district of Hayfield. The estimated expenditure is £8,000.

Newport Electricity Undertaking.—On May 25th the Local Government Provisional Order (No. 7) Bill came before the Examiners, and was ordered to be reported for second reading. The Bill provides for altering the Newport Corporation Acts of 1900, 1902 and 1906. It is pointed out that the Corporation were granted a provisional Electric Lighting Order in 1891, under which they were supplying electrical energy within the borough. In 1900 and 1902 the Corporation were empowered to borrow certain sums for the purpose of the electrical undertaking and their tramways, and it was now expedient that further provision be made with respect to the borrowing of money for the purposes of a power station. The Order provides that moneys to be hereafter borrowed shall be borrowed under the sanction of the Local Government Board.

Patents and Designs Act.—In Thursday's Parliamentary Papers, Mr. Rees asks the President of the Board of Trade whether, under the Patents and Designs Act of 1907, British inventors will be liable to have their patents revoked, on the ground that the patented articles or processes are being manufactured or carried on

exclusively or mainly outside the United Kingdom, in cases in which British manufacturers have declined to accept reasonable offers made by the patentee of licences to manufacture or work the patent inside the United Kingdom. Mr. Churchill, in reply, states that the patents in question will be liable to be revoked unless the patentee gives satisfactory reasons why the patented article is not manufactured or the patented process is not carried on to an adequate extent in the United Kingdom. "It will be for the Comptroller in the first instance, subject to an appeal to the court, to determine, after hearing the evidence on both sides in each particular case, whether the reasons given for non-working are satisfactory or not. It is, of course, impossible for me to say that the mere fact that one or more British manufacturers to whom the patentee may have made overtures, with the object of inducing them to work his patent, have not seen their way to accept such overtures can safely be relied upon by a patentee as a defence to an application for the revocation of his patent under the Act or to an action for infringement."

MUNICIPAL TRAMWAYS ASSOCIATION.

THE annual meeting of the members of the Municipal Tramways Association was held at Wolverhampton on Thursday and Friday in last week. Delegates from Nottingham, Birmingham, Leeds, Sheffield, Glasgow, Manchester, Leicester, Huddersfield, Burton-on-Trent, Preston, Birkenhead, Salford, Bury, and other centres assembled at the Town Hall on Thursday morning, and received a cordial welcome from the MAYOR (Councillor Fred Evans). His Worship expressed the hope that the result of the discussions would be such as to benefit the Association and the department of municipal life represented. Tramway managers (added the Mayor) had enormous responsibilities placed in their hands, and it appeared to him that conferences like that could not fail to strengthen and assist them in many ways in carrying out their public duties.

ALDERMAN CRADDOCK, in the absence of the chairman of the Tramways Committee, joined in the welcome to the delegates. He said that the Lorain system in Wolverhampton was excellently managed, and they paid their way. They did not proclaim any profit until a sufficient renewals fund had been provided for. The Alderman declared that there were not 20 miles of track in the whole of the British Isles which had given so little trouble as the 20 miles laid down in Wolverhampton with the Lorain system. —MR. J. ALDWORTH (Nottingham, President of the Association) acknowledged the welcome on behalf of the delegates.

In the evening the delegates were entertained to dinner at the Star and Garter Hotel, by Ald. C. T Mander (chairman of the Wolverhampton Tramway Committee), who presided. The Mayor submitted the toast, "The Municipal Tramways Association," and in doing so, said candidly that he was one of the unfortunate individuals who, when the Lorain system was suggested for Wolverhampton, opposed its introduction, and he still thought its advocates had an abundance of faith in the action they took. He took that opportunity, however, of stating that everything that was said for the system had been realised, and their faith more than justified. He understood that though the Association had been formed only a few years it had accomplished excellent work. At the present time one of the most important subjects affecting tramways had reference to the control of brakes. They had read with dismay of the terrible tramway calamities in various towns, and he was glad to know that the matter was receiving the attention of the Association with a view to the prevention of such accidents in the future. The hours of labour, the rates of pay of tramway employés, standardisation, and the charges for electricity were among the questions the Association had under consideration. He understood that the members of that Association controlled practically 40 millions' worth of capital provided by the ratepayers of the kingdom. Municipal undertakings should not, in his opinion, be measured by the amount of profits handed over to the rates. Profit-making was not the principal reason why those great undertakings existed; they were primarily for the convenience and comfort of the people. He believed it was the desire of tramway managers to give to the public the best possible value for their money, and to take a sympathetic interest in the employés under their control. The tramway service had very largely to do with the comfort, convenience, recreation and health of the people, and that Association deserved every support and encouragement.

MR. ALDWORTH, in responding, said that although the Association was young, it had more than justified its existence, and had fully maintained the objects for which it was established. He mentioned one question which just now was vexing tramway managers. It was how to allow about 50 per cent. of the staff a holiday at Whitsuntide or in August to serve in the Territorial Army, and at the same time to run an additional service of cars. In these days of scientific research and inventive ingenuity, there was no such thing as finality in the construction and equipment of any electrical undertaking, and it behoved all managers to maintain their tramways at the high-water mark of efficiency. Touching on the financial side of tramways, he said if they were to remain a success, it could only be done by maintaining a strong financial position. He thanked the Tramways Committee and Mr. Luntley for the facilities afforded the members for inspecting every detail of the working of the Lorain system, and said they would all leave Wolverhampton much wiser on the subject of a surface-contact system.

ALD. MANDER, in replying to the toast of "The Chairman," referred to the Lorain system, and said he did not think 1 per cent. of the Wolverhampton people would exchange it for the overhead system. He spoke of the local working costs as lower than the average of most of the towns in England, and said that the operating costs were nearly a penny a mile less than they were at Manchester. This said much, either for the surface-contact system or for Mr. Shawfield's management.

Other complimentary toasts followed, and at intervals an excellent programme of music was admirably rendered.

The proceedings of the Association were transacted with closed doors. It may, however, be stated that during Thursday morning the question of car building by municipalities was introduced by MR. FERGUSON (Glasgow) and discussed, and Mr. LUNTLEY (manager of the Wolverhampton Corporation Tramways) subsequently read a paper on the Lorain surface-contact system. In the afternoon the members of the Association journeyed by special cars to the tramway depôt, where Mr. Luntley gave an explanation of the working parts of the Lorain system. On Friday MR. F. A. MITCHESON, accountant to the tramways department, Manchester, introduced the subject of "Tramway Rating Valuations and Income-Tax Assessments"; whilst MR. C. W. MALLINS, manager of the Liverpool Corporation tramways, in an excellent paper, discussed the question as to the distance where a tramway passenger paying a penny fare ceased to be remunerative.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Changes at Swansea.

It was with considerable regret that I read the leaderette in your issue of May 22nd, 1908, entitled "Municipal Electricity Economies." The article no doubt was based on local Press reports, and these, while being correct, must of necessity be considerably abbreviated from the full reports which are considered by the Committee, and, therefore, are apt sometimes to create a wrong impression. The following information may be of interest to you :—

As an outcome of the resignation of the chief assistant electrical engineer, I submitted my report to the Committee, which report advocated that the senior shift engineer be appointed to station superintendent at a salary of £130 per annum, and that the mains assistant be appointed to mains superintendent at a similar salary, both these salaries at the expiration of six months to increase to £143 per annum, and after a further period of six months, both salaries to be further considered with a view to increases, if the work in the respective departments had been satisfactorily carried out, which I have every reason to believe will be the case. My report further gives promotion and increases to other members of the existing staff, and provides for the taking on of additional staff.

It was never intended that the two gentlemen referred to should divide between them the duties of chief assistant electrical engineer without affording them additional assistance.

Incidentally, I might mention that my Council have always given me a free hand (with the exception of the clerical staff) in appointing assistants and workmen, and also in the fixing of salaries and wages, as they are of opinion that interference in this direction is not conducive to efficient working. Naturally, however, when a senior position becomes vacant I submit a report as to what I suggest doing. When a vacancy occurs, promotion from the existing staff is first taken into account, and if the vacancy can be efficiently filled by promotion, this is done, but not with any idea of throwing an undue amount of work on to any member of the staff, or with any intention of unreasonably curtailing salaries or wages. I have no doubt you will agree that the increasing of salaries by instalments has many advantages.

Dispensing with the services of a draughtsman came about for the following reason :—The draughtsman in question was never appointed on the permanent staff; his services were called in during the construction of the Corporation tramways, and when it was found his assistance was no longer required he was given due notice. He severed his connection with this department over six months ago.

Respecting the question of insurance, I think, perhaps,

some confusion has arisen out of this matter. The buildings and plant are insured against fire; the boilers and economisers against explosion; the staff and workmen against accident; accumulators are taken care of by a maintenance agreement with the manufacturers, and I think it may safely be taken that all the usual insurances have been effected. The question about which there was some discussion, was that of effecting an insurance to cover practically all risks.

I am particularly sorry to find that you consider my Corporation are adopting "economies" such as your "Leaderette" leads one to believe, in order to make their undertaking pay. I feel sure that if you will refer to the figures of each year's working, which are always forwarded to you with the greatest of pleasure, you will find that real and steady progress has been made from the commencement, and I am confident that the conditions under which the staff and workmen are employed will compare very favourably with other municipal electricity departments.

In conclusion, I would add that I am always only too pleased to furnish you with any information in connection with this department which may be of interest to you.

C. A. L. Prusmann,
Borough Electrical Engineer.

Swansea, *May 26th*, 1908.

[We are very pleased to publish this explanation of the circumstances in question.—Eds. E.R.]

Rail Corrugation.

May I be permitted to call attention to one more possible explanation of this very vexed question? I know that a large number of theories have been put forward, and I think I have read every article or letter that has appeared in the English and American technical papers on the subject. As far as I am aware, none of the writers have mentioned the probability of the ordinary spoked car wheels being a factor in forming corrugations in rails.

An ordinary spoked car wheel, as a rule, has five spokes, and if the path of the return current is analysed, it is quite clear that the current travels down each spoke as it presents itself in turn as the most direct path to the rail, but when the rim of the wheel is in contact with the rail half-way between the spokes on either side, the current must flow momentarily down both the spokes, and then change its path to one spoke as soon as the resistance through the one spoke to the rail is less than the resistance of the rim and spoke that was immediately before forming the return circuit.

Has this reversing action of the negative current anything to do with forming corrugations in rails? In my opinion it has, and were it possible to fix side rods on to the wheels, it would, I think (on an old track), be found that the wheels of cars on each section of a system would get into synchronism with the corrugations.

As to whether the piece of the rim of the wheel between the spokes would coincide with the bottom of the corrugation or a section either side of the spoke, it is difficult to express an opinion.

I may state that on this system I have found numbers of corrugations (measuring from the top of one corrugation to another) to be within ½ in. more or less, as compared with the measurement of the circumference on the tread of a wheel between spoke centres.

It would, I think, be of great interest to know if there is any electric railway or tramway system in the world using solid wheels (that is, wheels that have practically the same resistance from any point on rim to the hub or axle), and if so, is such a system troubled with corrugations, and to what extent?

There are, I know, on the market solid wheels with strengthening ribs on the inner side, but these would offer the same resistance features as the ordinary spoked variety.

Another point which I think has not been raised before is: is a system affected with corrugation that is fitted with an overhead negative return, *i.e.*, double-trolley wires, if so, to what extent?

Messrs. Dick, Kerr & Co. can doubtless throw some light on this question, as I understand they have equipped a system in Japan with an overhead return.

I trust the foregoing remarks, if they are opening fresh ground, will catch the eye of our leading traction engineers, and, perhaps, they will be good enough to express their views on this possible phase of the difficulty.

I. F. Jones, *Engineer,*
The Madras Electric Tramways (1904), *Ltd.*

Madras, *May 12th*, 1908.

Balancers.

I was very pleased to see the lucid and useful article on balancers by Mr. Imbery in your last week's issue.

Balancers have always struck me as being rather neglected, both by text-books and by the technical Press. The result is that little is known of them by operators generally.

I remember that when I was first installed in charge of a three-wire board, I diligently searched several books to learn something more of these machines, but with scant success.

I, for one, would like to see the subject even more fully treated than has been done by Mr. Imbery in his excellent article.

Old Switchboard Attendant.

[Articles on this subject were published in our issues of May 10th, June 14th and June 28th, 1907.—Eds. E.R.]

Audibility of Wireless Messages.

In your issue of May 1st, I noticed an article entitled "New Radio-Telegraphic Plant at the Eiffel Tower," in which it was stated that the object of the French Government in installing the station underground was to prevent outsiders from reading the messages by the sound of the spark. Though only a humble operator, I venture to say that this alone will not have the desired effect, as the noise by which an operator would be able to read a message from a high-power wireless station while he was standing at some distance from it does not proceed directly from the spark, but is caused by the brush discharge from the antennæ into the atmosphere.

I have noticed that in a 45-kw. station, where the spark was boxed up so that it was barely audible outside the room, the messages were easily readable at a distance of two miles from the station. At a distance of one mile the noise of the dots and dashes was much louder than just outside the spark room. While standing outside the station and directly under the antennæ, one would hardly notice the noise. Under certain atmospheric conditions at night the messages could be read by watching the glowing of the aerial wires each time they were charged by a dot or dash.

Unless the French Government have found some method of overcoming this difficulty, I fear that their expense to attain their object will have been all in vain.

Neil Macintyre.

San Francisco, Cal.,
May 16th, 1908.

Working Speed in Telegraphy.

I am inclined to think that Mr. E. Raymond-Barker somewhat over-estimates the effect which any of Mr. Marconi's statements to the Press would have on the cable shareholder. Any such effect as might occur has been largely discounted by unchallenged statement of an opposite kind, such as have possibly escaped Mr. Raymond-Barker's notice. I have myself been called upon by more than one newspaper representative desiring to obtain independent opinion in regard to Mr. Marconi's allegations; and I have secured copies of the *Morning Post* of October 9th; *Daily Telegraph* of October 19th; and *Daily Graphic* of August 16th, so that you may see that important sections of the London Daily Press have, after all, been more or less impartially disposed in the matter.

I admit that certain incorrect inferences might be drawn from Mr. Marconi's statements such as would be unfair to cable telegraphy; and I certainly regret that I had no

opportunity of seeing a proof of my Press interviews on the subject, for I should then have been able to render clear the difference between manual and machine transmission, simplex and duplex working, &c., showing that the automatic-duplex system was, for long distances, only applicable to wire telegraphy at present. This revision would have been especially desirable in the instance of the *Morning Post*, whose representative I saw in the course of a short interval previous to a lecture I was delivering at the Engineering Exhibition at Olympia.

But, as I have already suggested, I very much doubt whether over-statements on one side, or lack of technical details on the other, in connection with lay newspaper interviews would have, in themselves, any tangible influence with a cable shareholder—especially where the over-statements and inaccuracies emanate from an interested and optimistic inventor anxious for financial support.

Charles Bright.

Westminster, *June 2nd*, 1908.

The Testing of Galvanised or Zinced Iron.

It is a matter of considerable importance to engineers who use galvanised iron to know the amount of zinc that is applied per square foot of the surface. The thickness of zinc has hitherto been determined almost universally by the copper sulphate test, known as Preece's test, which consists in placing the galvanised iron in a saturated solution of copper sulphate for one minute, and continuing the immersions until it shows a red deposit of copper, which is a true indication that the zinc has been penetrated and the iron exposed. This test, when carefully carried out, is fairly reliable as regards hot galvanised iron, but it is found quite useless for the more recent forms of galvanising which are now being extensively used by the Government and large manufacturing firms, namely, electro-galvanising and Sherardising, for the following reasons.

On applying Preece's test to Sherardised and hot galvanised articles coated with an equal thickness of zinc, the former require from three to four times the number of immersions, which suffice to remove the zinc from the latter. When hot galvanised articles are placed in a saturated solution of copper sulphate, the copper is precipitated in a loose form, but when Sherardised, Cowperised or electro-zinced articles are similarly treated, the copper adheres firmly to the zinc and no fresh surface is exposed, apparently due to the deposit of zinc applied by the electro-zincing, Sherardising and Cowperising process having a fine matted surface.

It would appear from these observations that the apparently great resistance to corrosion of Sherardised iron when subjected to Preece's test is due to the protection of the zinc by the deposited copper, so experiments were made with a solution of ferric sulphate, which dissolves zinc without forming a precipitate on the zinc coating. To test this, known areas of Sherardised and hot galvanised plate were exposed to the action of ferric sulphate solution for an equal period, and the amount of ferrous salt formed by the reducing action of the zinc determined. The column headed "Weight of zinc dissolved" shows the relative corrosion :—

Sample No.	Zinc per sq. ft. Grammes.	Weight of zinc dissolved. Grammes.
1. Sherardised	26·908	0·080
2. Sherardised	26·908	0·074
3. Sherardised	22·93	0·057
4. Hot galvanised ...	22·12	0·058
5. Sherardised	31·116	0·034

Sample No. 2 was moistened with water and allowed to dry; the oxide formed appears to protect the zinc, and this protection is more marked if water is allowed to act for a longer period than was permissible in these experiments. It will be noticed that samples 1 and 2, which had a thicker coating than samples 3 and 4, dissolved to a greater extent than samples 3 and 4, and which had practically the same weight of zinc coating dissolved. Sample 5 was Sherardised copper, and although the zinc coating was the heaviest, yet the corrosion was in this case the least, probably due to the conversion of the greater portion of the zinc into brass. On testing this sample with copper sulphate solution, as in the other cases, instead of a brown precipitate of copper, a bright metallic deposit was obtained and no further action seemed to occur.

From the results of experiments, the copper sulphate test has been found to be quite unsuitable for testing electro-zinced, Sherardised or Cowperised surfaces; therefore it will be necessary in future to substitute some other test such as the ferric sulphate test or a modification of the copper sulphate test.

Sherard Cowper-Coles.

London, S.W., *May 26th*, 1908.

Placing Orders Abroad.

I note your correspondent "T," instead of answering my plain questions, suggests that I should study the subject in political papers—by political, I presume he means party. This suggestion, unfortunately, is somewhat out of date, as I did that years ago.

With regard to the remainder of his letter I have no concern, as it is simply a lecture to your good selves. Personally, I am quite content to leave the conduct of the ELECTRICAL REVIEW to the official editors.

I might here mention that the correct answering of the questions I raised has an importance far above any question of party; I am myself engaged—in a small way—in foreign trade, and it would be small consolation to think that I have been working in accordance with party principles if such turned out to be completely wrong.

In the meantime, I await replies to my questions.

Geo. W. Green.

London, *May 27th*, 1908.

Tungsten Lamp Patents.

Some time ago there were rumours that patent litigation was impending between the General Electric Co., Ltd. (who are apparently licensed to work certain German patents), and one or other of the makers or sellers of other tungsten filament lamps. These rumours probably emanated from internal unofficial sources. Subsequently, the General Electric Co. confirmed the rumours by a veiled threat in their trade advertisements, whilst in their recently issued catalogue they print a vague announcement to the effect that early steps will be taken to enforce their patent rights.

Still more recently, a member of the company read a paper before a scientific society, when he took occasion to make a similar nebulous statement.

It would be interesting to know whether we are to call this "British" fair play. If the company are going to fight, let them come out into the open and say so, and then we shall all know where we are. The object of the move is, of course, quite obvious, and no doubt the trade, as a whole, is alive to this fact.

Would it not be well, however, for the trade to consider the question of protecting itself, by obvious means, from unfair methods of this kind?

Scrutator.

[Several letters have been received too late for insertion in this issue.—EDS. E.R.]

Norwegian Water-Power Legislation.—It is announced from Christiania that the Norwegian Government has withdrawn the Bill laid before the Storthing in regard to legislation concerning the acquisition of waterfalls, mines and woods, the intention being to modify the scheme in material points. The proposals contained in the Bill, to which reference was made in this journal two or three months ago, are, in the first place, to be so altered in the new project that they will not so sharply differentiate between Norwegian and foreign companies. The acquisition of the rights in question will, however, also be made dependent upon the granting of a special permission by the State where the purchaser is not a foreigner or a company substantially formed with foreign capital, but is a Norwegian citizen or a complete Norwegian company having at least three-fourths of the capital furnished by Norwegians.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Tantalum Lamps.

A new type of wire-filament lamp has now been placed on the market by Messrs. Siemens Bros. Dynamo Works, Ltd., who are introducing a 25-volt "Tantalum" lamp for use with automatic transformers and on low-voltage circuits generally. The new lamp is for voltages of 24 or 25, and is supplied in 8 or 16 c.p. The 25-volt "Tantalum" lamp may be used for train lighting and private-house installations, especially in connection with small transformers. The bulb (fig. 1) is smaller than that of the ordinary carbon-filament lamp, but similar in shape. The lamps can be burned in any position.

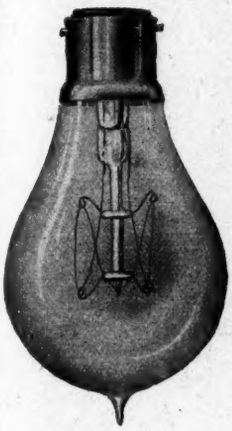


Fig. 1.—New Tantalum Lamp.

Loud-Speaking Telephone Receiver.

We illustrate herewith a loud-speaking receiver invented by Mr. N. D. Blagdon Phillips, of 27, Windsor Road, Ealing. This instrument consists, essentially, of two diaphragms in proximity, which are caused to vibrate in unison in opposite directions. The diaphragms, shown at d, fig. 2, are separated by a thin cardboard annulus c, which has a gap in it indicated at g. They are clamped together by the rings r. Where the gap occurs a tube t is fixed, to which a trumpet can be attached.

Close to the diaphragms are the poles of the magnets m, of the usual "watch" receiver pattern, and these are fixed on triangular wood bases w, which, in their turn, are each supported on three adjusting screws s. These last have shoulders formed on them for the purpose of riding in slots in the wood bases. The magnets may be connected in series or parallel.

It will be obvious that the diaphragms, vibrating as before mentioned, cause a volume of air to be admitted and expelled through the gap g, concentrating the effect and guiding it in a particular direction by means of the trumpet, so as to obtain the greatest possible intensity of sound.

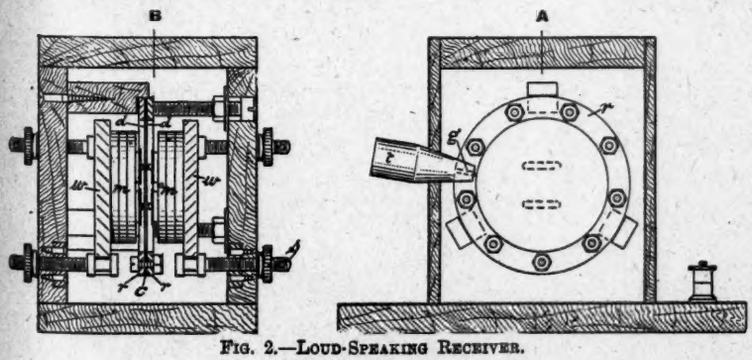


Fig. 2.—Loud-Speaking Receiver.

The Flitz Portable Electric Lighting Plant.

A somewhat novel design of portable electric lighting plant has lately been introduced by M. J. Flitz, ingenieur-constructeur, 13, Avenue du Roule, Neuilly-sur-Seine. Designed primarily for use in connection with a travelling cinematograph display, the idea of the designer has been to produce a plant which shall be readily transported, occupy as small a space as possible, be low in cost of upkeep and reliable in operation. The frame of the machine is built of pressed steel, as shown in fig. 3, and is supported on solid rubber-tired wheels, not by springs, but by a special form of shock-absorbing device, which prevents any vibration being felt in the building where the plant may be put to work. The wheel track of the machine has been kept as narrow as possible in order to permit of its being taken through ordinary doorways.

The petrol engine which acts as the prime mover is of 12-16 h.p.; it comprises four cylinders cast in pairs, with the inlet and exhaust valves all located on one side. The speed of the engine is controlled both by a throttle on the carburetter and by a variable lift of the inlet valves, reducing the fuel consumption, especially when the motor is running light, to a minimum. The normal speed is 850 revs. per minute. The ignition is effected by a high-tension magneto, while the water circulation for the cooling of the engine cylinders is controlled by a gear-driven pump in conjunction with a honeycomb radiator and air-inducing fan.

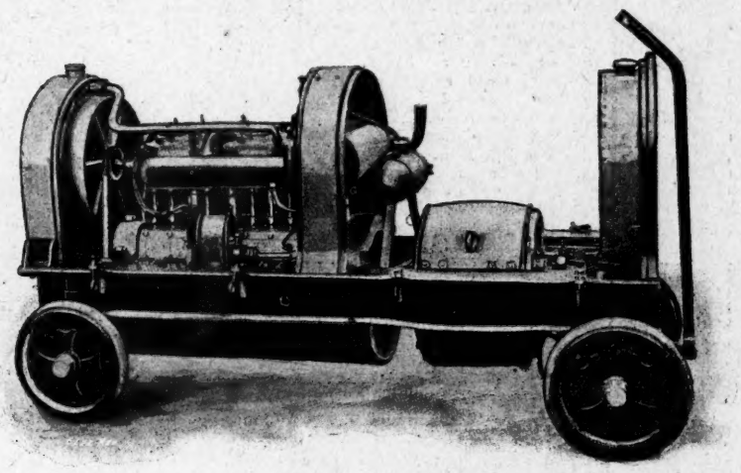


Fig. 3.—Portable Petrol-Electric Set.

The dynamo is of the Compagnie Française Electrique's construction, and gives a current of 90 amps. at 70 volts, equal to about 9 h.p. at 850 revs. per minute; it is of the ironclad enclosed type, and is thus unaffected by dust or oil. It is directly connected to the engine through the medium of a universally-jointed shaft.

A metal shield protects the under part of the engine, while the complete set is enclosed by two circular bonnets, which can be easily raised to give access to any of the parts. In the course of a recent trial lasting five hours, the plant worked both silently and without vibration, and without any variation in the intensity of the light of the projector being recorded.

Electrically-Driven Tools.

We illustrate in fig. 6, p. 946, a recent type of motor-driven car-wheel boring mill with improved automatic chuck, friction feed disks, and crane attachment. It is a 54-in. machine, and its heavy construction and powerful gearing render it capable of taking the heaviest cuts required for this class of work.

The automatic chuck is self-closing, self-opening, and self-centring. It has three adjustable abutments, each provided with an equalising steel jaw with two bearing points. The work is thus held and centred by six points on the circumference, ensuring accuracy in centring.

The first movement of the driving shaft causes the jaws to close in upon the work, after which the motion is transmitted to the table to produce rotation. When the work is completed, the chuck is released by disengaging the driving clutch and retarding the driving shaft by means of the friction brake provided for the purpose. The inertia of the table and work thus imparts the necessary force to open the jaws.

The work is secured in its correct position in the machine and released with no loss of time and without labour. Since the power of the clutch-grip increases with the resistance of the cut, it is never necessary to stop the table to tighten the chuck.

The boring mill is especially arranged for electric drive, and the motor is mounted on the vertical housing of the frame. The motor is a Westinghouse direct-current non-interpole type, with a variation in speed of approximately two to one, and therefore eliminates the cone pulley required by a line-shaft drive. This increases the machine capacity, as the variable-speed motor gives the desired range of speed in much smaller steps, permitting the mill to be run at all times at the maximum permissible cutting speed.

Fig. 4 shows a 6-ft. universal radial drill, which has recently been constructed by the Niles-Bement-Pond Co. As will be noticed at once, there are two drills mounted on a single 20-ft. bedplate. Each drill is independent of the other, and is driven by a 5-h.p. Westinghouse variable-speed motor mounted on its frame.

F

The adoption of an interpole motor was decided upon in order to provide for a wide range of speed without mechanical speed-changing devices. The speed of the motors shown can be varied from 400 to 1,600 R.P.M., and they will deliver their full rated horse-power for 12 hours' continuous service at any speed within the above range. Each motor is used not only for driving the spindle, but also for moving the column about the bedplate to any desired position. Either direction of traverse may be obtained by a reversing switch, which is not shown in the illustration.

The use of a variable-speed motor of wide range permits of the drills being run at all times at their maximum speed, regardless of the size of hole to be drilled, as the speed of the motor may be varied by small steps to suit the work being done. To provide for the circular movement of the columns by mechanical drive would have been very difficult if not impossible, but with the individual electric motor the difficulties are overcome in the simplest manner.

As each drill column must move half-way round the bedplate, an armoured cable protects the wires connected with the motor and supplies the necessary flexibility. The controllers for starting and governing the speed are mounted one on either side of the bedplate on a special frame, which also carries a double-pole, double-throw switch for reversing the direction of rotation of the motor.

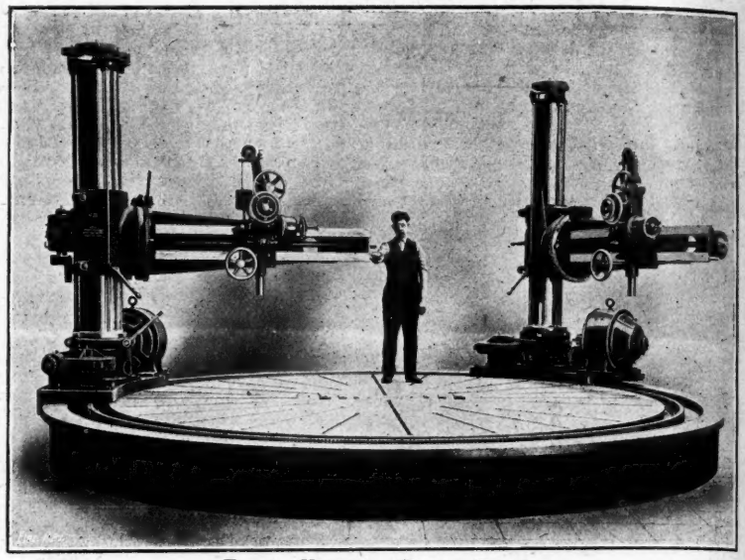


FIG. 4.—UNIVERSAL RADIAL DRILL.

A Modern Bottom Delivery Electric Charging Car.

In the up-to-date equipment of smelters and concentraters, which are to-day handling at good profits the low-grade material which no more than ten years ago was looked upon as worthless, electricity is the most important element, and the electric charging car, which is used to convey the material to the furnaces, plays an important part in the work.

After the ore has been received from the mines in railroad cars, crushed to the proper size, and deposited in storage bins, the electric charging cars come into play. These cars convey fuel as well as ore, and, in fact, handle all the raw material used and consumed around smelting plants.

The accompanying illustration, fig. 5, shows a type of car in use in a number of the largest American smelters and concentraters, known as the Atlas centre dump, swinging-door design. The door swings outward with the lever adjacent to the operator on the platform.

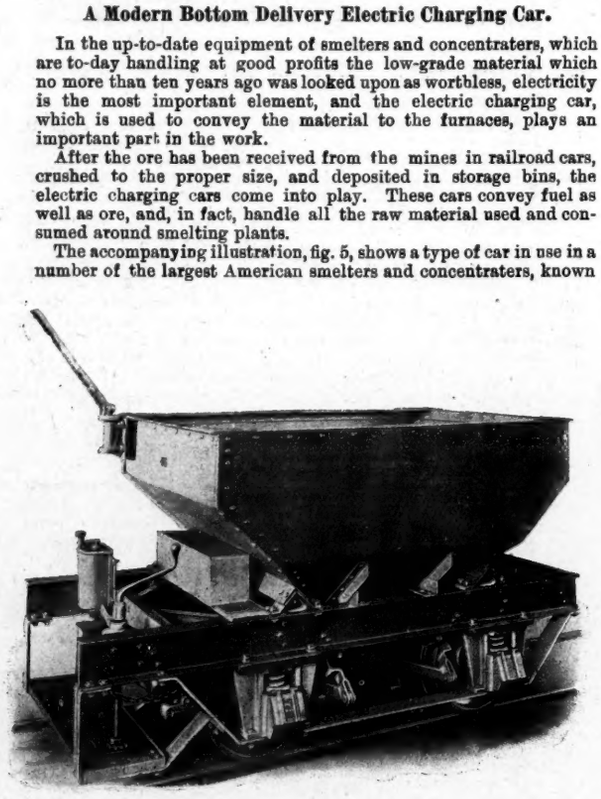


FIG. 5.—ELECTRIC CHARGING CAR.

The sides and ends of the car are of the steep angle design, so that the material will not adhere, thus giving a clean delivery.

The bearings are dust-proof and waste-packed to ensure protection and easy running. The brakes are of the standard tramcar enclosed ratchet-handle type.

The electrical apparatus consists of a Westinghouse motor, controller, enclosed resistance, circuit-breaker and cut-out switch, and a reversible spring-type trolley having a standard trolley-wheel. The cut-out switch is operated from the platform, and when the operator leaves the platform he cuts off the current. This is for safety and prevents accidents, particularly as these cars are operated under very close clearance conditions. The wiring is specially encased in water-tight conduits to protect against the gritty material which sometimes wears the insulation.

These cars are of 5 tons capacity, 3 ft. gauge, and are manufactured by the Atlas Car and Manufacturing Co., Cleveland, Ohio, the electrical equipment being made by the Westinghouse Co., of Pittsburg.

FIG. 6.—CAR-WHEEL BORING MILL (see p. 945).

Current Limiter.

A new form of current limiter has been introduced by the ELECTRICAL CO., LTD., of 121-125, Charing Cross Road, W.C., on the principle indicated in fig. 7. The device, which is made for both D.C. and A.C. circuits, consists essentially of a highly-finished switch A, an electro-magnet B, an oscillating balance C, and a pivoted locking lever (not shown). The coil and switch are in series, and are both traversed by the main current. Normally, with the switch closed, a pin on the lower extremity of the locking lever is held against a small toe on the circumference of the balance wheel by a spring, and prevents the balance from moving until the normal current has been exceeded. When this happens, a small iron plate D, attached to the balance, is attracted by the electro-magnet; at the same time the latter attracts a small locking armature carried on the pivoted lever on the left-hand side of the balance. This action at once draws away the locking pin from the balance, which is now set in motion due to the upward pull of its armature by the electro-magnet.

For a certain angular swing of the balance, the pin E which it carries engages with the forked end of the switch lever, whereby the switch is opened and the lamps in the installation are extinguished. At this moment the electro-magnet becomes demagnetised, so that the small iron plate is no longer attracted. The balance then swings back, and closes the switch by means of its pin. If the current still remains in excess, the balance will oscillate continuously until the current is reduced to the right amount. The

duration of the swing is made long enough to ensure that complete extinction of the lamps always occurs. As the consumer is quite incapable of doing any work with the light flickering in this manner, he is forced to switch off the excess lamps, and as soon as the current again attains the agreed-upon value, or less, the balance disk is brought to rest by means of the pin on the locking lever, which again engages with the small toe on the circumference of the balance, the swinging of which is now stopped. In this position the switch is closed, and the permissible number of lamps can then be burnt.

It is claimed that the design described has the advantage of great simplicity, positive action, reliability, and certainty in

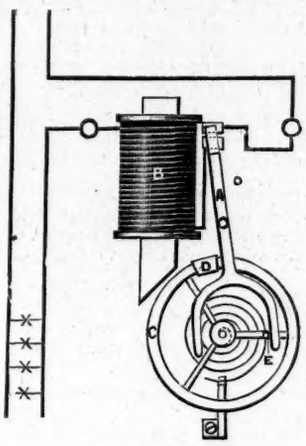


Fig. 7.—Current Limiter.

drawing attention to the overload. In some designs the lamps only burn dull when an overload takes place, there being sufficient light left for working; but with this current limiter the light flickers in a manner which is quite insupportable to the eye.

The instrument has a suitable metal switch with spring contacts, so that all the troubles due to the use of mercury contacts are avoided.

The sensitiveness of the apparatus is such that for an increase in the supply pressure of about 10 per cent. the apparatus does not operate prematurely when only the normal number of lamps is in circuit. Each apparatus can be used for a definite maximum current, and operates when this maximum is exceeded. By means of a sliding weight on the locking armature, the current limiter can be adjusted to operate between the limits of 50 per cent. to 100 per cent. of the maximum current.

Reyrolle New Starter.

We illustrate below the latest development of Messrs. A. Reyrolle and Co.'s drum-type starter. In this apparatus all the features of their drum-type starter are included, while a shunt regulator is

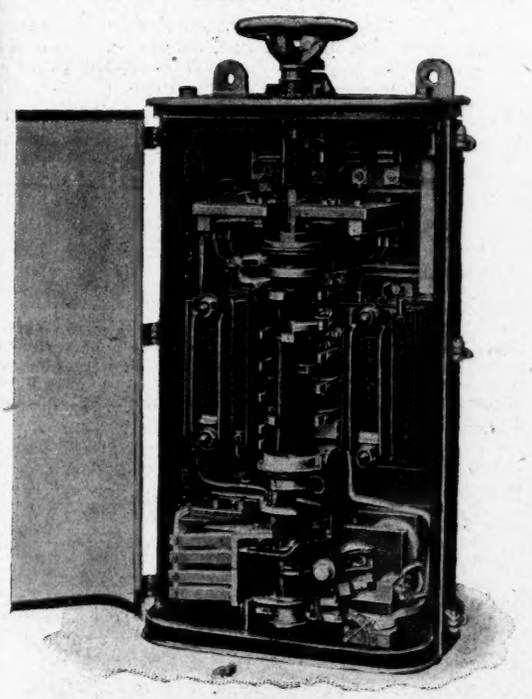


Fig. 8.—New Motor Starter.

added in such a way that the starting and controlling of the moto may be done by means of one handle, with the additional advantage hat the motor cannot be started on a weak field. The motor is started by bringing the drum to the starting position and waiting there until the motor starts (*i.e.*, it embodies the firm's patent resistance), after which the remainder of the resistance is cut out in the usual way. The handle is now in a position to commence the second or regulating revolution, and stops can be arranged so that the motor is brought up to a definite fixed speed every time it is started. The double-pole switch, which is an integral part of all Messrs. Reyrolle & Co.'s drum-type starters, is loose on the spindle, with the result that if a heavy overload comes on the motor, either when the starter is at the starting, full-on or regulating position, it is at once isolated from the mains. The apparatus has been designed with a view to standing the rough usage generally met with in shipyards, &c.

BUSINESS NOTES.

"Liconite."—Messrs. Geipel & Lange write, pointing out that in the article which appeared in our last issue on this subject, in the test of the 2-yard sample of paper-insulated leadless cable which had been immersed in water with its ends bare for seven days, we state that it broke down at 52,000 volts. This, of course, would in itself be a very satisfactory test, and one which they think no other cable in existence would stand; but, as a matter of fact, the breakdown commenced at 70,000 volts, and it was the disruption of the insulation at that pressure which caused the fall of voltage to 52,000 and the final puncturing. Had the voltage not been carried over 52,000 the cable, in their opinion, would not have failed at all. Messrs. Geipel & Lange add that they are acting as agents on behalf of Messrs. Hendrichs & Co., of Amsterdam, in this matter, and will be pleased to give information to any of our readers who may be interested in the subject. Cables insulated with "Liconite" are being exhibited at the Franco-British Exhibition.

Bankruptcy Proceedings.—John Hope Callcott, electrical engineer, lately trading in partnership at Clayton Works, Little East Place, Kennington, S.E.—The first meeting of creditors was held on Monday at the London Bankruptcy Court, before Mr. Daniel Williams, Assistant Official Receiver. A statement of affairs was submitted, showing total liabilities £5,191, of which £1,945 is expected to rank for dividend, and assets valued at £5 12s. absorbed in the preferential claims. It appears from the debtor's statements that having been engaged for many years as a civil engineer, he, in April, 1907, took a workshop at Kingland, and in conjunction with another person, who subsequently joined him in partnership, commenced business as electrical engineers, shortly afterwards removing to Clayton Works, Kennington, which premises he fitted up at a cost of £325. In March last his partner removed the whole of the machinery, and he (debtor) has been unable to trace his whereabouts. He attributes his insolvency to the result of an action arising out of a building contract at Whitminster, near Stonehouse; to losses in connection with the electrical business at Kennington, and to interest on loans. The meeting was adjourned for three weeks to give the creditors an opportunity to consider the terms of a proposal which has been lodged by the debtor.

Albert Lord (Lord Bros.), electrical engineer, 3, Ambush Street, Openshaw, Manchester.—Receiving order made at Manchester Court on May 27th, on creditor's petition.

Ernest Albert Gresham, 6, Harehills Avenue, Leeds, late Westborough, Scarborough, Yorks., late electrical engineer, &c. In this case the liabilities are stated at £103 16s. 8d., and the assets are estimated at £19 1s. 9d.

Walter Wardle, electrician, 14, Osborn Road, Levenshulme, Manchester. A receiving order was made on May 28th, on debtor's own petition.

Australian Tariff.—It is stated that in recent amendments in this tariff, telephones, telephone switchboards and appliances appear as being admitted free.

For Sale.—On June 17th Mr. E. H. Hawkins, 4, Charterhouse Square, E.C., the receiver and manager of E. & C. Braby, Lambeth, Willesden, &c., wholesale slate and marble merchants, will offer the business, goodwill, stock, &c., for sale by tender.

Holidays.—We have received from the London and South-Western Railway a copy of the Official Illustrated Guide and List of hotels, boarding-houses, seaside and farmhouse apartments.

Electric Clocks and the Daylight Bill.—Messrs. Gent & Co., Ltd., of Leicester, and 3A, Upper Thames Street, London, E.C., have issued a new pamphlet describing some of their latest patterns of B.P. patent silent electric impulse clocks. We understand that by using any number of these impulse clocks, attached to one transmitter, the clocks can be set forward or backward, according to the season of the year, from the central transmitter, without going to each individual dial; thus in all large buildings with a number of clocks in actual use, electrical operation provides a simple means of adjusting any number of clocks to any alterations that may be legalised in the use of daylight by altering the time standard. This will interest those of our readers who may be following the discussions on the present "Daylight" Bill.

Book Notices.—*Questions and Answers in Electrical Engineering.* By A. E. Moore, A.M.I.E.E., and Frank Shaw. London: Longmans, Green & Co. 2s. 6d.—This little booklet of 151 pages deals with the questions set in the preliminary examination of the City and Guilds of London. The answers to the questions appear to be worked out in great detail, so that a student who works through them need not fear the examination. The examination papers dealt with date from 1899 to 1907, and, consequently, there is a large selection. The book may be found useful by teachers in their elementary classes, and can be safely recommended to elementary students.

Farm Buildings, &c. By Thomas Winder. Pawson & Brailsford, Sheffield. Price 6s. 6d. net.—In this work of 171 pages there is a chapter on the application of electricity to farming and agriculture by J. W. Beauchamp (of Sheffield Corporation electricity department). This occupies 16 pages, and shows pictures of electric motors driving various implements used in agriculture. There appears to be little doubt that the use of electricity is somewhat neglected at present on farms, and it is rather a pity that in a treatise of this description Mr. Beauchamp did not seize the opportunity to give some details of the cost of operating motors, &c., when engaged in the usual farming operations, such as churning, cutting up faggots, driving threshing machines, &c. By means of the suction gas producer it seems to the writer that the farmer has now at hand a simple apparatus to supply gas to an engine at a small working cost, thereby rendering the distribution of electricity about the farm comparatively easy.

The *Report* of the Council of the City and Guilds of London Institute, for the year 1907, opens with the Charter of Incorporation of the new Technological Institution at South Kensington—the Imperial College of Science and Technology—of which the Central Technical College is an integral part. The Institute is represented by five members on the governing body, while the latter in turn appoints five additional members on the Committee of Management of the C.T.C. The preparation of an educational scheme for the Imperial College has made considerable progress. The number of students last session was 457, as compared with 435 in the previous session, but as before, the students in Electrical Engineering show a falling off, from 135 to 126, the lowest number since 1901-2, while the Civil and Mechanical Engineering Department shows a substantial increase. The Siemens Memorial Medal and Premium for the student of greatest merit in Electrical Engineering was awarded to J. W. Wheeler. The new wing of the Technical College, Finsbury, was opened in October last; here also there is a decrease in the number of electrical engineering students, which, it is remarked, has been observed all over the country, and is doubtless due to the overstocked and depressed condition of the electrical industry. The total income of the Institute for 1908 is estimated to amount to £45,659, and the expenditure to £45,178, of which the C.T.C. will receive £20,160, and the Technical College, Finsbury, £11,800.

"The Diseases of Workmen." By T. Luson and R. Hyde. London: Butterworth & Co. 1908.

"Le Nuove Lampade Elettriche ad Incandescenza." By G. Mantica. Vol. I. Milan: Antonio Cordani. 1908. Price L4.

"Modern Power Generators." By J. W. French. Two vols. London: Gresham Publishing Co. 1908. £2 2s. net.

"Science Abstracts." May 25th, No. 125, Sections A and B. London: E. & F. N. Spon, Ltd. 1908. Price 1s. 6d. per section.

"Telephones: Their Construction, Installation and Maintenance." By W. H. Radcliffe and H. C. Cushing. London: Crosby Lockwood & Co. 1908. Price 4s. 6d. net.

Catalogues and Lists.—BRUSH ELECTRICAL ENGINEERING CO., LTD., Victoria Works, Belvedere Road, S.E.—New 16 pp. illustrated list of Brush fans and blowers, showing desk, combined, revolving, ceiling, port-hole, and box-blade fans, also exhausters for belt-driving, and battery sets.

FELTEN & GUILLEAUME-LAHMEYERWEKE ACTIEN-GESELLSCHAFT, Frankfurt-Main.—Pamphlet just issued, describing in English, and with a number of illustrations, their totally enclosed motors with forced lubrication.

MESSRS. VICKERS, SONS & MAXIM, LTD., Sheffield.—This is a catalogue of half-tone illustrations from photographs of the electrical machine shops, and the electrical machinery made therein, at the River Don Works at Sheffield. Views of the erecting shop, and of the test-bed and 5-ton "Half-Goliath" crane working under the main shop cranes, are followed by excellent pictures of a 400-KW. steam-driven electric generator giving both A.C. and D.C.; a 500-B.H.P. Vickers' multipolar generator for driving steel-works, coupled to a gas engine (100 R.P.M. 220 volts); a 1,400-KW. dynamo (100 R.P.M.) arranged for mounting on a gas engine shaft, and a number of other examples of their electric generating machinery and motors for A.C. and D.C. work. Similar views of motor-generators and up-to-date motor-driven machines also appear.

THE ELECTRICAL CO., LTD., 121-125, Charing Cross Road, W.C.—Eight-page booklet, giving particulars of the firm's new flexible lamp strip for use with miniature lamps for indoor, outdoor, lawn, and other temporary or permanent illumination.

THE INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS CO., LTD., Silvertown.—Revised list (No. 27) showing sizes and prices—the latter in red—of gutta-percha, india-rubber, silk and cotton-covered wires, also jointing tools and materials for electric bell and shot-firing service, and for instrument and dynamo-coil winding. The works will be closed from Saturday next until Wednesday, 10th inst., for the Whitsun holidays.

MESSRS. S. COWPER-COLES & CO., LTD., Westminster, S.W.—Leaflet showing their centrifugal pumps for corrosive liquids.

ARMORDUCT MANUFACTURING CO., LTD., Farringdon Avenue, E.C.—12-page pamphlet containing full descriptive notes concerning their "Witton Grip" conduit fittings, with illustrations and particulars of prices. The company has now been able to accumulate stocks of these manufactures.

THE STAMPINGS ALLIANCE, LTD., Argyle Street, Nechells, Birmingham.—Leaflets giving illustrations of various drop forgings, of which they are manufacturers.

CROSBY STEAM GAGE AND VALVE CO., 147, Queen Victoria Street, E.C.—Pamphlet explaining the special methods used in the manufacture of their well-known pressure gauges; the tubes are screwed, not brazed, into the socket, and the latter supports both the movement and the tubes. All parts are interchangeable.

POWER PLANT CO., LTD., Temple Bar House, London, E.C.—List (D 1), describing and illustrating, and giving a table of prices of, the firm's patent D.R. (double-reduction) gears.

MESSRS. A. REYROLLE & CO., LTD., Hebburn-on-Tyne.—Two new pamphlets; one (No. 49) showing and describing their switchboards for testing work, the other (No. 51) being devoted to their isolating switches.

MESSRS. LENNOX & CO., 27, Essex Place, Turnham Green, W.—8-page pamphlet describing and illustrating their electric blowers, belt-driven blowers, rotary pressure and vacuum pumps, and stating prices of same.

MESSRS. SIEMENS BROS. & CO., LTD., Queen Anne's Chambers, London, S.W.—New catalogue No. 37, dealing in some 20 pages with the Obach dry cells and dry cell batteries. The matter and illustrations relate almost entirely to these cells for ignition purposes.

MESSRS. GENT & CO., LTD., 3A, Upper Thames Street, E.C.—Four-page illustrated leaflet, giving brief particulars and prices of, and wiring diagrams for, some new designs of their "Sergent" pattern secret intercommunication telephones, for which they claim many advantages and a very low price.

Dissolutions and Liquidations.—MESSRS. H. W. SAMBIDGE & SON, LTD., Highgate Street, Birmingham.—This company is winding up voluntarily with Mr. A. H. Gibson, 39, Waterloo Street, Birmingham, as liquidator.

HART SECONDARY BATTERY SYNDICATE, LTD.—Creditors must send particulars of their debts, &c., to the liquidator, Mr. J. H. Poulton, 85, Wallwood Road, Leytonstone, N.E., by June 15th.

SIMPKIN, WILKINSON & GIBSON, electrical and mechanical engineers, 66, Kirkstall Road, Leeds.—Messrs. F. Simpson, W. A. Wilkinson, and C. Gibson have dissolved partnership, Mr. Wilkinson retiring. Messrs. Simpkin & Gibson continue the business under the old style.

KLEIN ENGINEERING CO., LTD.—This company, meeting at Manchester last month, decided to wind up voluntarily with Mr. A. A. Gillies, 46, Brown Street, Manchester, as liquidator. Creditors must send particulars of debts to Mr. Gillies by July 13th.

J. D. JONES, BODDINGTON & CO., electrical engineers, 150, Finchley Road, N.W.—Messrs. J. D. Jones and B. J. Boddington have dissolved partnership. Mr. Jones will attend to debts, &c.

Stealing Electricity.—For stealing a quantity of electricity, valued at £6 12s., a miner, named J. Wilson, was summoned by the Northern Counties Electric Supply Co., of Bishop Auckland. Wilson pleaded guilty, and was fined five guineas, with the alternative of two months' hard labour.

Fire.—On Thursday evening last week a fire broke out on the premises of MR. J. H. AUSTIN, electrical fitter, Cleveland Street, Wolverhampton. The shop was completely gutted and much damage was done to the fixtures and stock.

Trade Announcements.—THE MAXIM ELECTRICAL CO., LTD., have removed their registered offices and stores to the Maxim Works, Shernhall Street, Walthamstow, which is now their only address.

The *Elektrotechnischer Anzeiger* gives notice of change of address to Schöneberger Strasse 10, Berlin S.W. 11.

THE ST. HELENS CABLE AND RUBBER CO., LTD., notify that from June 1st their London address is 174, King's Cross Road, N., where all communications should be addressed.

MESSRS. LANGSTON & JONES, of Teddington, are building a new electric workshop in High Street.

The ARMORDUCT MANUFACTURING CO., LTD., Farringdon Avenue, E.C., ask us to notify the trade that they have changed their two old telephone numbers to one number (with two lines) that everybody can remember, namely, "400 Holborn." The firm have in circulation an alphabetical telephone card for the convenience of their friends.

LIGHTING and POWER NOTES.

Aldershot.—The working of the Council electricity undertaking during the year 1907-8 resulted in a gross profit of £1,751, which, after meeting financial charges, leaves a surplus of £75. Some £214,292 units were sold, and the equivalent 8-C.P. connections now amount to 13,632.

Amersham.—The Chesham E.L. and Power Co. has informed the R.D.C. that it intends applying for a prov. order for E.L. within the Council's area.

Bargoed.—The Rhymney Valley Electric Lighting Syndicate is preparing to supply electric light for the compulsory area of Bargoed during the summer, and it is expected that every-

thing will be ready by the end of September. Messrs. Lewis and Fletcher, Cardiff, are the engineers.

Barrow-in-Furness.—The annual report in connection with the Corporation electricity undertaking shows a slight loss on the year. The capital expenditure of the works now amounts to £110,872, and the amount expended last year was only £2,027. The revenue account has increased by £745, but the costs have also increased by £1,080, the result being that the gross profit has gone down from £6,437 to £5,988, or a decrease of £49. The capital charges, which are rather heavy, have increased by £375, and the net result on the whole of the year's working is a loss of £791, compared with a profit last year of £33. The principal reason for the increased cost is due to the price of coal which has cost £655 more this year. There has been an increase during the year in the number of units sold for motor power and heating, the number of units having been raised from 138,000 to 221,000. The present works have a capacity able to cope with an increase of 30 per cent. without any increase in machinery.

Bexley.—Following tests of sections of the steam pipes at the Urban District Council's electricity works, work is to be carried out in order to effect improvement, at an estimated cost of £425. Messrs. Babcock & Wilcox are to substitute new piping for the whole of the piping on the superheated range, and a Sugden superheater is to be substituted for one of the existing Schmidt superheaters, the cost estimated being made up of £280 for steam piping, &c., and £145 for the new superheater.

Bray.—In our last issue we quoted the remarks of the chairman of the Electricity Committee on the state of his department's finances, which included what turns out to be an entirely erroneous statement, that the works involved a loss of £1,000 per annum. Actually, we are informed by Mr. Sowter, the engineer, the amount of the deficit is £390. It is a matter of surprise to us, and one would imagine of regret to the residents of Bray, that anyone capable of such indiscreet statements should have even nominal control of a municipal department.

Bury.—The annual report of Mr. S. J. Watson, the engineer, on the Corporation electricity undertaking, shows that over three million units were sold during 1907-8, as compared with 2,276,266 units in 1906-7. Of this amount, some 1½ millions units were supplied to the tramways, and nearly a million units for motive power and heating. There are now 69 hired motors of 593 H.P. and 140 privately owned motors of 937 H.P. connected to the mains. The individual load-factors recorded were:—Lighting, 12·2 per cent.; public lamps, 30·2 per cent.; motors, 27·3 per cent.; and tramways, 21·0 per cent., the combined load-factor being 20·5 per cent.

Canterbury.—According to the abstract of accounts just issued by the City Accountant, the income of the electricity department for the year 1907-8 was £8,699, being an increase on the previous 12 months of about £600. The number of units sold increased by some 9 per cent. The expenditure shows an increase of about £735, amounting to £4,621, £400 of which was represented by increased cost of coal, and the balance by the cost of a new feeder for public lighting in St. Dunstan's Street, and the fitting of tantalum lamps to the street lamps. The gross profits are equal to about 6¼ per cent. upon the capital expended, reaching the sum of £4,078. The net profit, after providing for interest, income-tax, capital repayment and sinking fund, amounts to £73.

Continental Notes.—FRANCE.—The electricity generating station which has been established at Jeumont (Nord), and which is intended to supply electrical energy throughout the industrial district of the valley of the Sambre, is now in operation. The plant has a capacity of 20,000 H.P., and of this 9,000 H.P. has already been supplied under contract, while other important agreements are under negotiation. The feeders of the station extend from Hautmont to Ferrière-La Grande.

ITALY.—La Società Minerario ed Elettrica del Valdarno has applied to the authorities of the province of Arezzo for a concession to put down a plant to utilise the water-power of the River Borio S. Cipriano at S. Giovanni Valdarno in the generation of electrical energy for lighting and power purposes.

Croydon.—The report of Mr. Alex. C. Cramb, borough electrical engineer, on the 11th year of the electricity undertaking, came before the B.C. on Monday, June 1st. The total expenditure shown was £31,133, an increase of £2,917, but on the total receipts there was an increase of £8,151. On capital account £6,730 was spent, bringing the gross outlay on the undertaking from the commencement to £339,203. To sinking fund £11,081 was allocated. On the year's working the net profit was £12,242, which, with the balance forward, made an available surplus of £14,490. The Lighting and Electricity Committee recommended that £12,000 of this should be placed to the reserve and renewals fund, leaving £2,490 to be carried forward. The number of consumers increased from 2,646 to 2,902, and the units generated increased by nearly a million to 7,005,141. The average price obtained per unit for private supply was 3·6d., a decrease of ·2d. Ald. D. B. Miller, in moving the report, pointed out that if the Committee's recommendation were carried, they would be in the proud position of having reached the maximum of reserve allowed under the provisional order, viz., 10 per cent. of the capital expenditure. Alderman Trumble, as chairman of the Tramways Committee, urged that the undertaking, in its prosperity, could now afford to be generous to its chief consumer. At 2d. per unit his Committee were charged 40 per cent. more than tramways elsewhere, while the average charge to a number of tramways around London, which he named, was 1·42d. per unit. The Committee's report, with the accounts, were unanimously adopted.

A L.G.B. inquiry was held on May 28th into the application of the B.C. for a loan of £13,500 for E.L. purposes. There was no opposition.

Dundee.—We understand that it has been decided to erect the new generating station at Carolina Port of brick instead of steelwork, as was included in the original estimates. Although this will represent an increase on the cost of fully £2,500, yet there will be less outlay on maintenance charges on a brick building. A substantial saving has already been effected by the purchase of plant at less than the estimated amount allowed for this item.

Eastbourne.—The L.G.B. has sanctioned the borrowing by the T.C. of £7,000 for extensions of the electrical undertaking.

Glasgow.—The Trustees of the Clyde Navigation have approved of a plan showing the extensions of the electric lighting at Rothesay Dock, Clydebank, to complete the whole installation, and they are asking for an offer from W. C. Martin & Co., the present contractors.

Ilkley.—A scheme for electrically lighting the district by harnessing the River Wharfe has been prepared by Mr. W. Antrobus, of Chorlton-on-Medlock. A further part of the scheme is to run the two plants day and night at full load, the surplus energy to be used electro-chemically on the spot (thermic or electrolytic). By this means the Council will be assured of remuneration.

India.—DACCA.—It is said that Messrs. Crompton & Co. have purchased the old electric light installation on favourable terms from the trust which has controlled it since its inception in 1902, and that they intend to remodel and modernise it.

CALCUTTA.—The spread of cholera in the Bengal coalfields has affected the coal output to such an extent that on several occasions recently the Electric Supply Corporation ran short of fuel, and in consequence the electric supply to the city was erratic.

The Municipal Corporation has had to reconsider the question of city lighting; after having decided in favour of gas, the Government Advocate-General gave it as his opinion that the calling for tenders, and the subsequent acceptance of a tender, was not in accordance with municipal by-laws, and was, therefore, illegal. At present it is uncertain what course of action will be adopted, but it seems probable that gas will eventually be decided upon.

LUCKNOW.—The new Medical College is in course of construction, and a big scheme of power and electric lighting should shortly be ready; public tenders will, no doubt, be called for.

Llandudno.—The T.C. hopes to transfer from the electric light fund the sum of £600 to the relief of the rates.

The Council has applied to the L.G.B. for sanction to borrow £566 excess expenditure over the loan of £12,172 which was sanctioned in June, 1900.

London.—MARYLEBONE.—The Borough Council has had under consideration the question of revising the present rates of charges for the supply of electrical energy, and the practicability of framing a tariff that should be applied universally throughout the borough. The consulting engineer (Mr. Arthur Wright) reported that it would be commercially inexpedient to raise the average price received per unit, or to interfere during the present year with the option which the old "Metropolitan" consumers have of remaining on their original scale of charges. With reference to the standard D.I. tariff, he thought that the change should at once be made of basing each summer quarter's account on its own maximum demand instead of upon the mean of the demands during the winter months. He also considered advisable a revision of the meter rents, and further, that in those cases where a consumer is prepared to guarantee his load factor, or the total annual consumption per KW. of demand, the manager should be authorised to quote such consumer a flat rate corresponding to his load factor or consumption per KW., so as to enable a quarterly bill to be made out on a flat rate at the nearest farthing above the calculated figure. The Electric Supply Committee reported that the average price realised from all classes of supply during the year ended March, 1907, was 4·54d. (exclusive of meter rentals), and during the year ended March, 1908, it had fallen to 4·22d. Allowing for a further slight fall in price by reason of other "old" consumers taking advantage of the option in rates, it was estimated that the average price for the year ending March, 1909, on the present rates, would be 4·136d. The Council decided that the existing scale of charges should be continued until June 30th, 1909. Each quarter's account is to be based on the actual demand for the quarter.

The Electric Supply Committee, submitting estimates for the year ending March 31st, 1909, reported that the expenditure requirements depended, in some measure, on the probable sales. For the year just ended the total sales to private consumers would reach the figure of 8,533,000 units estimated for. Although the undertaking had already suffered decrease in income, owing to the high efficiency lamps put on the market recently, it was felt advisable to allow for a further drop in total sales, and instead of estimating for an increase of 500,000 units as last year, the Committee limited their estimate of increased sales to 250,000 units, or a total of 8,780,000. The total costs of production for the six months ended December last (for an annual output of 8·5 millions) were at the rate of 1·49d. per unit. The costs for a similar output this year would not exceed 1·4d. It was mentioned that there was every prospect of the total sales to private consumers being greater than the 8·78 million units estimated, as there were several very large

prospective consumers. The estimated deficiency, £6,967, would, it was explained, be met out of the credit balance of £29,325 in hand at March 31st, 1907, which would not be depleted by more than £3,000 at March 31st, 1908.

The estimates for capital expenditure, amounting to £10,600 (which, like the estimate of £166,652 on revenue account, was approved) were as follows:—Generating station, for coal and ash-handling plant, £510; staying thermal storage drums, £750; spare armatures for coal crane and ash conveyor, £55; sundry expenditure, £285; mains department, for new services, £900; new meters and demand indicators, &c., £1,600; extension of distributing mains, new disconnection boxes, &c, £2,500; alterations to Aybrook Street sub-station buildings, £4,000. The last-named item is the estimated cost of alterations and re-arrangement of the sub-station premises, decided upon by the Council in order to improve the accommodation for the distributing staff.

FULHAM.—The Electricity Committee of the B.C. has decided to extend mains and provide transformers, &c., at a cost of £350, in order to give an electricity supply to the Wall Paper Manufacturers, Ltd. The company proposes in the first place to install two motors, aggregating from 70 to 80 H.P., at its works, and in due course it intends to install further plant.

POPLAR.—In order to meet an increased demand from the London and India Dock Co., the B.C. is to lay new cable and ducts at an estimated cost of £337. Existing cable, &c., of the value of £215, is to be reclaimed, so that the net capital cost will be £121. It is proposed to erect a new sub-station in East Ferry Road on a site to be leased from the Millwall Dock Co.

HAMPSTEAD.—The Lighting Committee recently submitted a comparative statement of income in connection with the electric lighting undertaking, which showed a total for the year ended Lady Day, 1908, of £65,738, as compared with £64,587 for the previous year. In respect of energy sold, the income amounted to £60,582, as compared with £57,475 for 1906-7, other items being meter rent, £2,059 (as against £3,870); other charges, £126 (as against £91); public lighting, £2,970 (as against £3,150). The Finance Committee has appointed a sub-committee to consider the present system of accounts in connection with the works and electric lighting departments, including stores and wages, and to report as to any change that may be desirable.

PADDINGTON.—The negotiations between the Metropolitan Electric Supply Co. and the B.C., with regard to the proposed removal of the company's generating station and the suggested reduction in the price charged for electricity, were in abeyance for some time in consequence of the company's assessment appeal being pending. Since the decision in the appeal, however, negotiations have been reopened, and the General Purposes Committee of the B.C. states that it hopes soon to be able to present a report upon the matter.

Nottingham.—Mr. H. Talbot, the electrical engineer, has just issued a report on the working of the electricity undertaking, from which the following particulars are culled. The total H.P. at the three generating stations is 15,685, and there have been 46 extensions of the distributing mains. The number of consumers on March 31st, 1908, was 3,462, compared with 3,257 last year. There were 841 motors, an increase of 99. The number of units sold during the 12 months for various purposes was, for lighting, 4,112,648; for power, 1,709,208; for traction, 5,294,979—total, 11,116,835, an increase of 1,586,739; 50·95 per cent. of the units used for private lighting were at the reduced rate of 1½d. per unit. The accounts show that the sale of energy realised £89,380; public lighting, £1,541; and rent of meters, £1,491, the total income being £92,784. The expenditure amounted to £41,087, the chief items being, for coal, £13,815: oil, waste and water, £2,953; wages, £7,157; repairs to engines and boilers, £3,680; rates and taxes, £6,965; and salaries, £4,126. There was a balance of £45,705, of which £13,681 went in interest, £12,654 in repayment of loans, and £11,500 in aid of the general district rate, £5,500 being transferred to the reserve fund.

Richmond (Dublin).—The Joint Committee of the Richmond District Asylum is about to appoint a consulting engineer to prepare plans for wiring the Asylum for electric lighting. Applications have to be sent to W. J. Murphy, chief clerk, Offices, Grangegorman, Dublin.

Rotherham.—The B. of G. has instructed the General Purposes Committee to take into consideration the present cost of lighting the workhouse by gas, and the advisability of substituting electric light.

Wednesbury.—The Corporation is still encountering difficulties in connection with the establishment of its electric light undertaking. It has received a further notice from the Midland Electric Corporation for Power Distribution, Ltd., of its intention to break up the principal streets of the town in compliance with the powers alleged to be contained in the Midland Electric Power Distribution and Lighting Order, 1898. The Corporation has retaliated by moving a motion of disapproval of such action upon the company. Meanwhile the Corporation has received from the L.G.B. sanction to the borrowing of (*a*) £273 to defray excess expenditure on electricity meters up to March 31st, 1907; (*b*) £1,346 to defray excess expenditure on electricity mains up to March 31st, 1907; (*c*) £1,200 to meet prospective expenditure on electricity mains and services. As a consequence the Corporation proposes to borrow these amounts.

West Bromwich.—The annual report of the Corporation electricity undertaking shows that the total revenue for the year amounted to £12,971, against £13,033 last year. There is an increase in the sales for lighting of £52, and for motive power £387, but for tramways, a decrease of £132. The total expenditure on the trading account amounted to £6,914, against £6,540 in the preceding year, an increase of £374. The revenue account was charged with interest on loans and Corporation stock and the proper instalments for redemption and extinction of debt, amounting in all to £4,026, leaving a surplus for the year of £2,030, a decrease of £593.

York.—During the past financial year the revenue amounted to £15,824, leaving a gross profit of £7,697, which was absorbed in interest and loan charges. The deficit on the suspense account has increased during the year from £4,907 to £4,927. Some 86,771 equivalent 8-C.P. lamps are connected up, and the E.L. Committee is considering the question of duplicating the cables across the River Ouse with a view to facilitating supply on the west side.

TRAMWAY and RAILWAY NOTES.

Argentina.—On May 28th a collision occurred on the San Martin Railway, Buenos Ayres, between a passenger train and an electric tramcar. Five persons were killed and 60 others injured.

The Berlin correspondent of the *Financial News*, says that the General Tramway Co., of Buenos Ayres, in which a number of German banks and financial firms are interested, has obtained an exclusive concession for working all the tramways of the city and suburbs.

Barnes.—The District Council at its last meeting discussed an offer by the promoters of the West London, Barnes and Richmond Tramways Bill with regard to street widenings. The promoters offered (*a*) to make the Council an immediate payment of £45,000 in respect of street widenings, or (*b*) that the Barnes Council should raise £75,000 for the purpose by loan, the company to guarantee the repayment of principal and interest, the Council's security to be a first charge on the entire undertaking, including the part outside its area. This proposal would provide for a road 45 ft. wide throughout the route of the tramways in the town. In reply to this offer a resolution was moved that it be referred to the Tramways Committee to consider as to the best means of developing a service of electric trams, but this was rejected.

Belfast.—The question of the agreement with the Cavehill and Whitewell Co. has been discussed at considerable length, and finally the resolution of the Committee, which agreed to give a through service from Glengormley to Castle Junction, all fares on the city lines to go to the Corporation, and all collected on the company's lines to go to it, was approved of by a majority, and the details were left to the Committee. The Corporation reserved the right of purchasing the undertaking at any time within five years at a sum not exceeding £60,000.

Blackburn.—The Corporation tramways during the past year (ending March 25th, 1908) received £59,822 in revenue, the working expenses amounted to £39,197, and the balance was sufficient to cover all financial charges and leave a surplus on the year of £805. Some 1,104,000 car-miles were run, and 10,900,000 passengers carried, the receipts averaging 12·52d. per car-mile. Since August, 1907, the Blackburn cars have been running through into Accrington, under a working agreement between the two corporations.

Continental Notes.—GERMANY.—Electric traction is to be adopted on the Insterburg-Allenstein and Insterburg-Lyck sections of the Prussian State Railways.

Eastbourne.—A deputation from the Corporation 'Bus Committee has recently visited London and inquired into the working of the electrobus. The London Electrobus Co. is to send down a vehicle for trial over the existing routes.

Kirkcaldy.—It is reported that the gross receipts of the Kirkcaldy Tramways for the year amount to £14,546, and the miles run total 459,065. Last year's figures were:—Receipts £13,488, and miles run 466,919, showing an increase of £1,058 in receipts and a decrease of 7,852 in the miles run. The year's result is approximately £1,200 better than that of the previous year.

Manchester.—The Tramways Committee has expressed to the Finance Committee of the Corporation its readiness to bring its contribution to the city fund, in relief of rates, to a total of £70,000 for the year.

Middlesex.—At the meeting of the County Council on May 28th, the Light Railways Committee reported that the contract for the construction of the tramway, High Road and Church Road, Willesden, had been completed by Messrs. Dick, Kerr & Co., the contractors, at a cost of £54,926. The estimated cost of the works was £46,500. The additional expenditure of £8,426 was made up of extras in respect of excavation and concrete works to drains, special works to properties (compensations), &c. By far the largest items were for extra concrete to secure good foundations for the trackwork and roadway. When the works were in progress it was found necessary to fill in concrete to a much greater depth in certain portions of the road than was anticipated, owing to bad foundations.

Rhondda Valley.—Preparations for the opening of the Rhondda Tramways route are being speedily pushed forward. On Monday the members of the local Council were, at the invitation of the general manager, Mr. Nesbitt, conveyed on a trial trip over the Rhondda-fach section, and to Pont Rhondda on the other section, a distance of about 9 miles. The generating plant to be installed will be of the latest type, including three 500-H.P. engines, and 50 double-decked cars will be available for service over the route which extends over 25 miles. The company controlling the tramways will be known as the Rhondda Tramways Co., the Council having leased to it the powers obtained through Parliament. Under an agreement the company will pay the Council a rental of £2,250 per annum. The B. of T. inspection of the route is expected to take place shortly.

Southport. — The Corporation tramways during the past 12 months had total receipts of £18,916, against £18,483 last year, and an increased expenditure of £168. The gross profits have been £7,521. Passengers carried increased by 79,623.

Sunderland.—The annual report of the Corporation tramways for the year ended March 31st has just been issued by Mr. A. R. Dayson, general manager and engineer. During the year experiments had been made with an improved type of suspension of the overhead line in Roker Avenue. New cables had been laid throughout the northern section of the system, these having been supplied by the British Insulated and Helsby Cables of the paper-insulated type. During the year 16,987,898 passengers were carried, as against 17,483,132 in the previous year. The tramways revenue account showed a gross income of £69,024. Of this, traffic receipts were £68,798, equal to 10·759d. per car-mile; advertising on cars, £66; rents on properties, £155; and sale of lost property, £4. The gross receipts worked out at 10·795d. per car-mile, as against 11·314d. for 1907. The gross working expenditure was £40,817, equal to 6·384d. per car-mile, against 6·378d. per car-mile in the previous year, and the amount carried to the net revenue account was £28,207, equal to 4·411d. per car-mile, as against 4·935d. per car-mile for 1907. From the net revenue account, £19,479 is carried to the appropriation account, to be disbursed as follows:—Repayment of loans, £9,380; reserve and renewals fund, £5,677; car-covers, &c., £302; Wheatsheaf offices' account, £400; clock and instruments, £373; in aid of borough fund rate, £3,348. The reserve and renewals account stands at £36,654, with balance of reserve fund, £5,000; compensation reserve fund, £2,000; renewals fund, £27,268. The sum of £2,386 is appropriated for various renewals. The capital expenditure stands at £290,124. The amounts of loans repaid total £61,405. There are some notable decreases upon the previous year, but in view of the exceptionally bad trade experienced in the town and the very wet summer season, the results are regarded as satisfactory.

TELEGRAPH and TELEPHONE NOTES.

Cape Colony.—The gross telephone revenue for 1907 was £45,768, an increase of £735 over 1906. The gross annual rentals amounted to £43,265, and the call office fees to £1,165, being increases respectively of £927 and £118 on the preceding year. Working expenses amounted to £33,370, a reduction of £2,741 on the previous year's figures, mainly due to the postponement of all but immediately necessary maintenance works. Interest and depreciation charges were considerably increased, consequent on additional capital expenditure incurred, the result being a net loss of £3,195 on the year's working, as compared with a loss of £5,089 in 1906.

Glasgow Telephones.—The deficit of £16,000 resulting from the transfer of the telephone undertaking of the Corporation to the Government will be met out of the revenues of the Common Good, over a period of five years.

Hull Telephones.—The annual statement of accounts shows a total outlay of £54,747; the revenue was £9,567, and the expenditure £5,596. Interest and sinking fund absorbed £2,916, leaving a net surplus of £1,055. £214 was allocated to preliminary expenses, and £1,578 to reserve fund, which was brought up t £2,846. There are 2,500 instruments connected.

Telegraph Conference.—At the plenary sitting of the Conference on May 27th, a letter signed by the submarine cable companies was submitted by the representative of the Anglo-American Telegraph Co., calling attention to the damage caused to trans-Atlantic cables by trawlers fishing off the Irish coast.

One of the cable ships engaged in repairing cables recently found a cable damaged by a trawler for some 250 fathoms; the cable was flattened and strained, and the core opened out in places. Two pieces of trawlers' net were found on the cable.

The Government has no jurisdiction outside the three-mile limit.

World's Telegrams.—The Bureau International des Administrations Télégraphiques has just published telegraphic statistics for 1906, compiled from official documents, and some idea will be gained of the enormous volume of telegraphic business from the following figures, which cover all classes of telegrams, paid, free, inland and foreign:—Germany dealt with 52,490,981 telegrams; the Commonwealth of Australia and Tasmania with 14,454,114 telegrams. The figures for other countries are as follows:—Austria, 18,846,187; Belgium, 7,771,462; Bosnia, 708,253; Brazil, 1,723,871; Bulgaria, 1,496.062; Cape, 3,169,067; Portuguese Colonies, 264,951; Denmark, 2,803,341; Egypt, 5,934,239; Spain, 5,170,649; France and Algeria, 57,874,120; Great Britain and Ireland, 93,771,000; Greece, 1,540,775; Hungary, 10,017,452; British India and Indies, 24,912,336; Dutch Indies, 843,118; French Indo-China, 1,137,633; Iceland, 3,814; Italy, 15,812,569; Japan, 24,909,842; Luxemburg, 209,275; Natal, 700,312; Norway, 2,554,842; New Zealand, 6,603,497; Orange River Colony, 559,886; Holland, 6,333,205; Portugal, 3,758,554; Roumania, 3,309,358; Russia, 28,280,333; Senegal, 176,791; Servia, 722,889; Sweden, 3,602,568; Switzerland, 5,106,697; Tunis, 922,292; Turkey, 6,333,357; and the United States of America (Western Union Telegraph Co., 1905), 67,477,320. It will be seen that the above do not include the figures for all countries, but those above quoted give a grand total of 482,307,012 telegrams.

Telegraphic Interruptions and Repairs:—

	Cables.	Interrupted.	Repaired.
Curacao-Coro Curacao-La Guayra Curacao-Maracaibo	Closed	.. Jan. 12, 1906 ..	..
Tarifa-Tangier		.. Jan. 18, 1904 ..	..
Port Arthur-Chifu (Closed)		.. Mar. 9, 1904 ..	..
Las Palmas—Arrecife		.. May 18, 1908 ..	..
Cayenne-Salinas		.. May 9, 1908 ..	..
Gibraltar-Tangier		.. May 22, 1908 ..	May 26, 1908
Pera-Dardanelles		.. May 20, 1908 ..	..
Dardanelles-Constantinople		.. May 26, 1908 ..	May 26, 1908
Dardanelles-Constantinople		.. June 1, 1908 ..	..
Sierra Leone-Accra		.. May 28, 1908 ..	..
Lagos-Accra		.. May 28, 1908 ..	May 31, 1908
Trinidad-Demerara		.. June 1, 1908 ..	..
	Landlines.		
Puerto-Barrios		.. Aug. 2, 1902 ..	..

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—June 15th. Electrical goods for the Powell Duffryn Steam Coal Co., Ltd., 101, Leadenhall Street, London, E.C. Stores Manager, Aberaman offices, near Aberdare.

Antwerp.—June 18th. The Commercial Intelligence Branch of the Board of Trade have received from the Acting British Consul-General at Antwerp a specification issued by the Antwerp municipal authorities in connection with calls for tenders for the supply of 1,600 metres of electric cable. A deposit of 2,000 fr. (about £80) will be required. Tenders to Monsieur le Bourgmestre de la Ville d'Anvers, Hôtel de Ville, Antwerp. Specification may be obtained from the Hôtel de Ville for 0·50 fr., but copies may be consulted at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Australia.—Perth.—September 7th. 650 telephone wall sets, 150 table sets, various switchboards, other instruments, protectors, &c., for the Postmaster-General's department. Some particulars can be seen at the Electrical Review office.

Melbourne.—July 3rd. One 500-kw. motor-generator, for the electricity supply department. See "Official Notices" May 8th.

Perth.—September 7th. The Postmaster-General requires tenders for one common-battery switchboard, of nine sections in all, together with all associated frames, racks, power plants and parts for Fremantle Exchange.

Adelaide.—July 1st. Telephone and telegraph instruments, switchboards and line material for the Postmaster-General's department. Specification may be seen at Electrical Review office.

Adelaide.—July 7th. The Municipal Tramways Trust requires tenders for supply, delivery and erection of motor equipments and car-wiring.

Adelaide.—July 14th. The Municipal Tramways Trust requires tenders for (1) rotary converters, transformers, boosters, switchboards; (2) equipment of converter stations Nos. 1 and 2; and (3) supply, delivery and erection of storage battery at converter station No. 2.

Austria.—June 15th. The municipal authorities of Kofiach, Styria, are inviting tenders for the establishment of a central electric lighting station in the town.

Belgium.—June 17th. La Société Nationale des Chemins de Fer Vicinaux, 14, Rue de la Science, Brussels, is inviting tenders for the supply and erection of the overhead conductors and the electric rail connections on the Brussels-Grimberghen section of the Brussels-Humbeek electric railway. The specifications (Nos. 25 and 30) can be obtained on payment of 1 fr. each, and the drawings for a fee of 24 fr.

Belgium.—June 25th. The municipal authorities of the little towns of Amay and Ampsin (Liége) are inviting tenders for the public and private electric lighting of the two communes.

Bradford.—June 10th. E.L. installation at the Town Hall extension, for the Corporation. Specification, &c., from City Architect, Whitaker Buildings, Brewery Street, Bradford.

Bulgaria.—June 19th. Construction of an electric station for supplying light and power to the Government coal-mines at Pernik. Specification, in German, can be seen at the Commercial Intelligence Department of the Board of Trade.

Dartford.—June 9th. Oils, meters, house-service cable, &c., for the U.D.C. See "Official Notices" May 8th.

Dundee.—June 13th. Electricity meters for the Corporation.

France.—June 18th. The municipal authorities of Paris are inviting tenders for the supply and erection at the Colombes sewerage station, at Gennevilliers, of two sets of centrifugal pumps and three-phase electric motors.

Galicia.—August 31st. The municipal authorities of Stanislau are inviting tenders for the establishment of a central electric lighting station in the town.

Gillingham.—June 22nd. Coal for the B.C. electricity department. See "Official Notices" to-day.

Ilford.—June 10th. Condensing plant, piping, switchboard extensions, &c., for the U.D.C. electricity department. See "Official Notices" May 22nd.

L.C.C.—June 23rd. Tramway feeder pillars. See "Official Notices" to-day.

Malvern.—June 29th. 50-KW. steam alternator, exciter, &c., for the U.D.C. electricity works extensions. See "Official Notices" to-day.

Manchester.—June 19th. D.C. motors and motor-starters, meters and fuse-boxes, for the Electricity Committee. See "Official Notices" to-day.

Norwich.—June 9th. Water-tube boiler, mechanical stoker, and wiring supplies for the Electricity Committee. See "Official Notices" May 29th.

Russia.—The municipal authorities of Marionpol are about to invite tenders for the establishment of a central electric lighting station in the town.

Servia.—June 12th. The Servian Telegraph authorities in Belgrade are inviting tenders for the supply of 100 tons of galvanised-iron wire.

Spain.—The *Gaceta de Madrid* of May 22nd contains a copy of a Law authorising the Spanish Government to call for public tenders for the construction and installation of the new submarine telegraph cable from Cadiz to Teneriffe, thence to Gran Canaria, Palma y Gomera, from the latter island to Hierro, from Gran Canaria to Fuerteventura, and from thence to Lanzarote. Tenders are to be invited during the course of the present year, and the total cost, not to exceed 5,000,000 pesetas, is to be distributed over two years. Local representation is necessary.—*Board of Trade Journal.*

Stepney.—Tenders are to be invited by the B.C. for annual supplies of meters, demand indicators, time switches and arc lamp carbons, and for about 12,000 tons of coal—a proportion of Welsh smokeless and a proportion of hard bituminous steam coal (large and small).

West Bromwich.—June 12th. Ventilation of Greets Green and Golds Hill Schools for the Education Committee. Specifications, &c., from A. D. Greatorex, Borough Engineer, Town Hall, West Bromwich.

Willesden.—June 18th. 300-KW. converting plant for the U.D.C. See "Official Notices" to-day.

CLOSED.

Arran.—The following is a list of tenders received for the electrical installation at Arran for the Marquis of Graham (Messrs. Stevenson & McGuffie, consulting engineers, Glasgow):—

Lowden Bros. & Co.	(accepted)	£5,184
Edmundson's Electricity Corporation		5,209
Kennedy, Stark & Co.		5,302
Anderson & Munro		5,489
Cox-Walkers, Ltd.		5,730
Allan Arthur & Ure		5,999
Watson & Co.		6,188
Drake & Gorham		6,228
Johnson & Phillips		6,475

Australia.—BRISBANE.—Postmaster-General. Erection of two-wire telegraph line between Geraldton and Harvey's Creek, 26½ miles, including 54 chains of submarine cable (Schedule 124). Brisbane Electrical Co., £1,577.

SYDNEY.—Postmaster-General. Annual supplies:—

1,500 ear-pieces for Ericsson's receivers, 7d. each; 350 cords for metallic switchboards, 2s. 7½d. each; 1,000 cords, combination, Ericsson four-conductor, 1s. 4d. each; 3,000 W.E. Co.'s receivers, 6d. each; 200 yards single switching cord, 5½d. per yard; 150 miles copper wire No. 20, S.W.G. india-rubber and paraffined cotton insulated, £2 10s. per mile.—International Electric Co.

200 junction switches and bell complete, 19s. each.—R. B. Hungerford.

30 milliampere meters, moving coil, dead-beat type, £3 18s. 8d. each; 15 lb. solder covered with 12 g. resin B.W.G., 2s.—India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

Belgium.—Twelve concerns, including two British—Callender's Cable and Construction Co. and the British Insulated and Helsby Cables—submitted tenders to the Société Nationale des Chemins de Fer Vicinaux, of Brussels, for the supply of the underground armoured cables required for the lines in what is known as the Littoral district. The lowest was that of the Süddeutsche Kabelwerke, of Mannheim, which quoted £15,089.

Birmingham.—The Corporation has specified the use of the "Thermit" rail joint in connection with the reconstruction of the Bristol Road tramways.

Bolton.—The tender of Messrs. H. Bessemer & Co. for steel tires has been accepted by the Bolton Tramway Committee.

Cape Town.—The tender of Messrs. Cunningham and Gearing, of Cape Town, has been accepted for the electric wiring and fittings at the new Corporation baths (£235).

Derby.—The T.C. has accepted the tender of Messrs. Johnson & Phillips, Ltd., for the supply of bitumen cables, at £471.

Fairhaven (Lancs.).—The tender of Messrs. H. Leake and Co., of St. Annes, for the electric light installation (600 lights) at the new King Edward VII School at Fairhaven has been accepted.

Falkirk.—The Corporation has placed the contract with the Chloride Electrical Storage Co., Ltd., for replating the battery and supplying one of their "Entz" type boosters and switchboard.

Halifax.—An order has been placed by the Electricity Committee with the British Westinghouse Co., Ltd., for 16 (35-H.P.) railway motors, at £69 each; also for 16 T.I.D. controllers, at £22 each. The British Thomson-Houston Co. have received an order to supply eight sets of G.T. resistance boxes, B type, at £7 5s. per set.

The Electricity Committee has accepted the tender of Messrs. Luke & Spencer, Ltd., for a single-wheel universal grinding machine, for £19 15s.

Hanley.—The T.C. has accepted the tender of the British Westinghouse Co., Ltd., for the supply of a 500-KW. steam-driven generating set.

Lancaster.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for a new switch panel, at £67, and a pressure regulator, at £302 10s.

Leyton.—The U.D.C. received the following tenders for the supply and maintenance of telephonic communications and electric call bells to firemen's residences (23 bells and four telephone circuits):—

	Per annum.
National Telephone Co.	£54 10 0
Stuart & Moore .. (accepted for 7 years)	48 10 0
Headland & Headland (plus £220 15s. for installation) ..	11 0 0
" " (for existing system)	18 0 0

The system is to be handed over to the Council at the end of the seven years in thorough working order.

At the last meeting of the U.D.C. the electrical engineer reported that it was necessary to increase the plant at the generating station. In order to get in another traction dynamo without the costly expedient of another traction set, he proposed to set back the large Willans engine of the lighting side of the station one bolt hole and interpose a traction dynamo of 440 KW. capacity between it and its present dynamo. This would enable the engine to be used either on traction or lighting. The expense of carrying out this work would be little more than the cost of the dynamo, switch panel and cables—say £895, of which £650 would be the cost of the dynamo. The Lancashire Dynamo and Motor Co. had offered to divert a dynamo of suitable size to the Council's use and to complete and erect it in working condition by July 24th for £650. The British Westinghouse Co. also offered a dynamo for £672, but this machine was too large to go in the space available. The Council accepted the offer of the Lancashire Co. and of Messrs. Bertram Thomas at £86 for a switch panel and extension of the switchboard. The engineer has been instructed to obtain quotations and accept the lowest for connecting cables.

The engineer has been experimenting with mechanical furnaces for burning slack coal, and recommends one made by the Underfeed Stoker Co., Ltd., as likely to prove successful. One is to be purchased for £434, and the company will take payment monthly, according to the saving effected, agreeing to restore the boiler to its present position if no saving is effected.

In connection with the conversion of public arc lamps, the Oliver Arc Lamp Co. will allow 17s. 6d. without the globe for each old type arc lamp of their make displaced by their flame arc, and 2s. 6d. for each globe returned to them. They will, without charge, enlarge the magazine of the six flame lamps of their make which are already in use. The cost per lamp, with weatherhood, contact gear and winch, including the 17s. 6d. allowance, will be £10 8s. 6d. The engineer having reported that the flame arc lamps erected on trial by the Oliver Co. were burning reliably and steadily, the Council has decided to use the lamps of this company for the conversion of 24 lamps in the High Road.

London.—ST. PANCRAS.—The B. of G. has accepted the tender of Mr. J. C. Christie for the supply of one gross of incandescent electric lamps, at 8s. 6d. per dozen. Two other quotations were obtained, at 9s. 6d. per dozen respectively.

Bermondsey.—The B.C. has received the following tenders for plant extensions at the electricity works:—

Boiler.

D. Adamson	£2,455
Babcock & Wilcox	(provisionally accepted) 2,025
Ed. Le Bas	1,290

Steam Dynamo.

		Price of motor.	Total price.
British Westinghouse Co.	Belliss	£285	£5,233
" "	Brush	265	5,285
" "	Allen	265	5,217
" "	Browett	265	5,264
" "	Turbine	290	5,286
*Electric Construction Co.	Belliss	370	5,065
" "	Allen	370	5,110
" "	Browett	370	5,095
†General Electric Co.	Howden	246	5,071
" "	" 1,000 kw.	246	6,597
" "	Browett	246	5,184
" "	" 1,000 kw.	246	6,942
" "	Belliss	246	5,189
Richardsons, Westgarth & Co.	Brown-Boveri turbine	—	6,396
British Thomson-Houston Co.	Howden	268	5,104
" "	Bellis	268	5,164
" "	Browett	268	4,994
Howden & Co.	Elec. Constn. Co.	222	4,922
" "	Phœnix	222	4,891
" "	Gen. Elec.	222	4,847
" "	B.T.-H.	222	5,071
" "	Lanc. Dynamo	222	5,276
" "	Crompton	222	5,042
Electrical Co.	Belliss	222	4,910
‡Phœnix Dynamo Co.	Belliss	177	4,764
" "	Browett	177	4,829
" "	Allen	177	4,778
§Parsons & Co.	Turbines	200	5,110
" "	1,000 kw.	200	6,520
" "	Crompton	200	4,826
Lancashire Dynamo Co.	Belliss	382	5,218
" "	Allen	382	5,398
Siemens Bros.	Belliss	262	4,892
" "	Allen	262	4,918
" "	**Howden** (provisionally accepted)	262	4,828
" "	Browett	262	4,960
" "	Parsons	—	—
Brush Elec. Engineering Co.	Brush	320	4,982
" "	950 kw.	320	6,110
" "	Turbine 750 kw.	320	4,477
" "	" 1,000 kw.	320	6,705
*Browett	Elec. Construction	218	4,873
"	General Electric	218	4,988
Willans & Robinson	Crompton, turbine	218	3,868
" "	" 1,000 kw.	218	4,653
" "	Siemens	218	4,528
" "	" 1,000 kw.	218	5,788
" "	Brown-Boveri	218	4,829
" "	" " 1,000 kw.	218	5,967

*£205 added for cable. †£26 10s. to be deducted.
‡£30 to be deducted for switchboard, and £93 to be added for cable.
§Alternative prices £6,276, £5,919, £7,359.
‖£270 added for cable connections.

Condenser and Cooling Tower.

J. Storey-Balcke	£2,824
" Zibberlast	2,714
" Blasberg	2,739
" Evaporative	3,087
J. P. Hall & Sons	2,692
Parsons & Co.	2,476
" " 1,000 kw.	3,028
Blasberg Co.-Haste	2,560
" " Hall	2,650
" " J. Storey	2,726
Haste Pump Co.-Midland	2,342
" " Blasberg	2,539
Mirrlees Watson Co.	2,657
Deane & Beal (25 in.) evaporative (provisionally accepted)	3,374
Balcke-Storey (?)	2,781
Brush Co.	2,497
" 950 kw.	2,504
" Turbo, 750 kw.	2,461
" " 1,000 kw.	2,868
Willans & Robinson	2,950
" " Turbine	2,372
" " " 1,000 kw.	3,024
W. H. Allen-Balcke	2,729
British Westinghouse Co.-Storey	2,913
" " Worthington	2,875
" " Storey (turbine)	2,876
" " Turbine	2,650
Richardsons, Westgarth-Westgarth (turbine)	3,325
Ledward & Beckett, 25 in. (tank not to specification) evaporative	3,886
Worthington Pump Co.	2,646
¶Midland Engineering Co.	2,498
Thomas Barton-Allen (second-hand steam-driven pumps)	750

¶£70 can be deducted if protected type motor instead of enclosed.

Southwark.—The B.C. has received the following tenders for an induced-draught plant (which is to be installed at the electricity station in order to overcome difficulty experienced in maintaining steam—especially during the period of maximum load—in consequence of which the electrical engineer has been unable to get the boilers blown down for cleaning and repairs during the winter months):—

	Fan.	Motor.	Total.
Jas. Howden & Co.	£325 0	£347 0	£672 0
Sturtevant Engineering Co.	235 0	235 0	470 0
Davidson & Co.	(Inclusive)		395 0
Musgrave & Co.	140 0	265 0	405 0
General Electric Co.	125 0	219 10	344 10
Crompton & Co.	177 10	278 0	455 10
Buffalo Forge Co.	125 0	222 10	347 10
Pooley & Austin	155 0	242 0	397 0
Baxter & Caunter	168 0	237 10	405 10
Electrical Ordnance & Accessories Co.	(Inclusive)		485 0
Electrical Construction Co. (provisionally accepted)	(Inclusive)		390 0
Lancs. Dynamo & Motor Co.	180 0	263 15	443 15
Bunsted & Chandler	188 10	266 10	455 0
Mathews & Yates	152 0	222 10	374 10
Mather & Platt	160 0	295 0	455 0
Siemens Bros. & Co.	(Inclusive)		417 0
J. Crawford	164 10	303 0	467 10
Heenan & Froude	194 0	225 0	419 0

The electrical engineer's estimate for plant was £475, including the necessary structural work and flue connections. It is proposed to carry out the necessary fixing and fitting of the machinery and cutting away and building up of brickwork, at an estimated cost of £145, with the staff of the electricity station, under the engineer's supervision.

Manchester.—The Electricity Committee has accepted tenders as under:—

British Westinghouse Electric & Manufg. Co., Ltd.—400-kw. transformer.
British Thomson-Houston Co., Ltd.—High and low-tension switch panel.

The Tramways Committee has accepted the following tenders:—

F. Smith & Co., Ltd.—30 miles hard-drawn copper trolley wire.
Steel, Peech & Tozer, Ltd.—Steel tee-girder rails and fishplates.
Hadfield's Steel Foundry, Ltd.—Special rail crossing in connection with the Sir W. G. Armstrong, Whitworth & Co.'s tramway at Openshaw.

Rugby.—The E.L. Committee has accepted the tender of Messrs. Bornand & Co. for 800 yds. of service cable.

Tasmania.—According to the *British Australasian*, six tenders were received by the Postmaster-General for the construction and the laying down of a new cable between Tasmania and the mainland. Four tenders were British, one German and one French.

Walthamstow.—The U.D.C. has accepted the following tenders for the supply of plant for the generating station:—

Siemens Bros. Dynamo Works, Ltd.—Two engines and dynamos, £3,595.
Babcock & Wilcox, Ltd.—Boiler house plant, £7,420.
Ledward & Beckett, Ltd.—Condensing plant, £9,370 10s.
Alphons Custodis Chimney Construction Co.—Chimney, £856.
Johnson & Phillips, Ltd.—Switchboard, £641 15s.
Paterson Engineering Co.—Water softening and purifying plant, £425.

Tenders for two sets of engines and dynamos, in addition to the tender of Siemens Bros. Dynamo Works, Ltd., were received from the General Electric Co., Ltd., British Thomson-Houston Co., Ltd., Electric Construction Co., Ltd., and Dick, Kerr & Co., Ltd.

The Light Railways Committee has decided to accept the tender of Estler Bros. for the supply of 14 sets of patent block system signals, with lamp attachments, at £19 10s. per set.

Worthing.—Nine tenders were received for condensing plant at the electricity works, and the T.C., acting on the advice of their resident engineer, Mr. G. Porter, has accepted that of the Midland Engineering Co., Ltd., at the price of £830. The tenders were as follows:—

Klein Engineering Co.	£1,596	Société Anonyme Westinghouse	£1,120
G. S. de Ritter	1,229	Worthington Pump Co.	918
Haste Pump Co.	1,100	**Midland Engineering Co.**	830
Cole, Marchant & Co.	1,092	Korting Bros.	770
J. Storey & Sons	1,005		

The last-named tender, and also three alternative tenders from the Société Anonyme Westinghouse, were, it is stated, not in accordance with specification.

CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERDEEN.—Hall for South Parish Church (£800).

ABERTRIDUR.—Twenty houses for the Old Mill Cottage Club. J. H. Phillips, architect, Clive Chambers, Windsor Place, Cardiff.

ABRAM.—Proposed Mortuary, W. H. Roby, surveyor, Council Offices, Abram; further developments contemplated by the Pearson & Knowles Coal and Iron Co., Ltd.

ADLINGTON.—Boiler and engine houses for Gerrard & Son, Ltd.

AINSWORTH (near Bolton).—Repairs and alterations at Parish Church Schools. Rev. A. Wood, vicar.

AMBLESIDE.—Proposed infectious diseases hospital (£850).

AMERSHAM.—Houses at Chalfont St. Peter for G. Sargeant, Mr. Grace, Mr. Ryder, and Mr. Bartington; house and shop, Prestwood, for Hooper & Nash; houses at Ley Hill, for Mr. Robinson.

ANDERTON (near Chorley).—Proposed Council school. County architect, Preston.

ANNAN.—Alterations and additions to the Academy for the Annan School Board (£5,750).

ASHFORD.—School in Woodthorpe Road. T. J. Hawkins & Co., builders, Victoria Street, Westminster, S.W.

ASHTON-IN-MAKERFIELD.—Houses in Princess Road, A. Watson; five shops, Wigan Road, T. Evans; new hotel for Ellis Warde, Webster & Co., Ormskirk; houses for T. Williams, junr.; two houses for Thos. Higson; proposed alterations at Holgate and Far Moor Girls' Schools. County Educational Department, Preston.

ASTON MANOR (near Birmingham).—New theatre. J. Parkinson & Sons, Ltd., builders, Blackpool.

ATHERTON.—Houses in Wigan Road. W. M. Rogerson.

BARNSLEY.—Proposed new Grammar School in Shaw Lane. Barnsley Education Committee.

BATH.—Proposed chapel at West Camel. Mr. Clothier, Camel Hill, Queen Camel, Bath.

BECKENHAM.—Houses, Blandford Road and Arrol Road, for E. F. Smith; Villiers Road, for S. Stenning; Oakwood Avenue, for Marsland and Sons; Cromwell Road, for G. Weaver; Stanley Avenue, for J. Andrews; additions to "Lunesdale," Graham & Co., builders, 36, High Street, Beckenham.

BELFAST.—Alterations at Springfield Road Dispensary for the Belfast Union. J. W. Robb, clerk to the Union, Union Workhouse, Belfast.

BELLSHILL (Lanarkshire).—Buildings on Marshall's Ground, Motherwell Road, for the Bothwell Parish Council.

BELPER.—Proposed Girls' Home in Holbrook Road, for the Board of Guardians.

BIRKENHEAD.—Development of estate of 80 acres at Whitby, Ellesmere Port. Langford & Slater, estate agents.

(Wirrall).—Alterations and additions to the administration block of the hospital for the Wirrall Joint Hospital Board.

BIRMINGHAM.—Proposed rebuilding of St. Lawrence's Church of England School, Dartmouth Street.

School for Girls for the Governors of Edward VII Schools. J. A. Chatwin & Son, architects, 128, Colmore Row, Birmingham.

BIRSTALL (near Leeds).—Twelve houses in Leeds and Elland Roads, I. Nelson, contractor, Birstall; four houses, for W. Nelson. I. Nelson, contractor, Birstall.

BIRTLEY.—Proposed new premises for the local Co-operative Society.

BISHOP AUCKLAND.—Proposed extensive additions to the workhouse, for the B.G. (£16,900).

BISHOP STORTFORD.—Additions and alterations to the Workhouse Infirmary. A. G. Gwynn, clerk to the Guardians, 29, North Street, Bishop Stortford.

BISPHAM (Lancs.).—Houses, Warbreck Drive, for A. Midgley; Cavendish Road, for T. Twelves; Red Bank Road, for T. Middlehurst; additions to hotel for Chester's Brewery Co., Ltd., Ardwick Brewery, Manchester.

BLACKBURN.—Two higher elementary schools at Blakey Moor, both to be lighted electrically. Briggs & Wolstenholme and Stones and Stones, joint architects.

BLACKPOOL.—Alterations and additions at St. John's Schools. Managers.

Houses, Read's Road, T. Hartley; Jackson and Arnold Streets, J. Wood; Whitegate Drive, F. Ayre; St. Helier's Road, J. Hodgson; Lytham Road, T. Carter; Ormond Avenue, S. Orme; Bank and Johnson Roads, A. Cardwell.

New Council School to be built on Hornby Estate. Blackpool Education Committee.

New St. Peter's Church, Lytham Road, South Shore. Potts, Son and Hennings, architects, Birley Street, Blackpool.

BLAYDON (Co. Durham).—Houses at Ryton Barmoor, for the Blaydon Industrial and Provident Society.

BOLTON.—Council Schools in Brandwood Street, at Tong Moor, Tonge Fold and in Devonshire Road. Director, Education Department, Bolton.

New Hotel in Bradshawgate. T. Smith, architect, Acresfield, Bolton.

New Hotel in Deansgate, Bolton, for Manchester Brewery Co., Ltd.; five houses and shops, Wigan Road, Mrs. Turner; additions to works in Blake Street, J. Roberts; additions to economiser house, Halliwell Street Mills, Greenhalgh & Shaw.

BOURNE.—Isolation Hospital for the R.D.C. in contemplation.

BRIDGNORTH (Salop).—Dual Secondary School for the C.C. (£5,868). Pritchard & Pritchard, architects, Kidderminster.

BRIDGWATER. — Additions to municipal buildings (£8,500). F. Parr, architect.

New Schools at Somerset Bridge (£2,300). Samson & Cottam, Bridgwater.

BRIGHTON.—Proposed Boys' School in Dyke Road, Preston (£18,000). Brighton Education Committee.

Wiring for E.L. in the West Street Shelter Hall (estimated £35). Works Committee.

Alterations and additions to the Pelham Street Schools for the Education Committee. T. Simpson & Son, surveyors, 17, Ship Street, Brighton.

BRISTOL.—Council School at Kingsdown (£7,389). W. S. Skinner, architect, Baldwin Street, Bristol.

BROADSTAIRS.—Houses, Edge End Road, for C. Philpott; St. Peter's Road, for J. W. Hall; additions to the Balmoral Hotel, for T. Wilson

BROMLEY (Kent).—Houses, Salisbury Road, for C. Fairman; Fairfield Road for F. G. Crickett; County School for Girls, Nightingale Lane, for the Kent Education Committee.

Cookery room at the Farnborough Council School. W. H. Robinson, architect to the Kent Education Committee, Caxton House, Westminster, S.W.

BROOMHILL (Northumberland).—Additions to the Red Row Club premises. G. Reavell, jun., architect, Alnwick.

BURNHAM (Somerset).—New Technical Institute (£1,400). D. Watson, Clerk to Council.

BYFLEET (near Weybridge).—Proposed new church. Mr. Caroe, architect.

CAERPHILLY.—Sixteen houses for the Energlyn Building Club. J. H. Phillips, architect, Clive Chambers, Windsor Place, Cardiff.

CAIRNSCROSS and EBLEY.—Shops and bakery for the local Co-operative Society.

CALDERBROOK (near Littleborough).—Proposed new Vicarage.

CAMBORNE.—Houses, Eny's Road, for Mrs. Heard; and Penponds, for Mrs. Moffatt.

CAMBRIDGE.—Proposed Eastern Counties Training College for Women at Chesterton (£30,000).

CANTERBURY.—Conversion of printing offices in High Street into restaurant. Bateman, builder, St. Dunstan's Street, Canterbury.

CARDIFF.—Warehouse in Wood Street, for C. C. Joseph. E. W. M. Corbett, architect, Castle Street, Cardiff.

CARNFORTH.—Business premises at Arnside for the Carnforth Co-operative Society. H. E. Illingworth, architect, 8, East Parade, Leeds.

CASTLEBLAYNEY (Ireland).—New Post Office.

CHELMSFORD.—Proposed offices for Essex Education Committee (£4,000). W. Whitmore, county architect, Chelmsford.

CHELTENHAM.—Enlargement of the General Hospital (£3,000).

"Empire" theatre. Wylson & Long, architects, 16, King William Street, Strand, W.C.

CHEQUERBENT (Bolton).—Development of workings. Hulton Colliery Co., Ltd.

CHORLEY.—Houses, Bolton Road, for D. M. Aspden, solicitor; Clover Road, for Geo. Burgess; Harper's Lane, for T. W. Hall; Mayfield Road, for Geo. Marginson.

CLAYTON-LE-MOORS (Lancs.).—New Council school. Secretary, Clayton-le-Moors Education Committee.

CLIFTON (Manchester).—Colliery developments (electrical included). Clifton and Kearsley Coal Co., Ltd.

CORK (Macroom).—Schools. S. F. Hynes, architect, 21, South Mall, Cork.

COVENTRY.—Children's Homes at Foleshill and Stoke for the Board of Guardians. T. F. Tickner, architect, High Street Chambers, Coventry.

CROYDON.—Houses at Biddington, for H. A. Rayner, and cottage, Blandford, and cottage and bungalow at Beddington, for Rev. Father Roe.

Group of schools in Tavistock Grove (£12,000). Walter Wallis, builder, 207-9, High Road, Balham, S.W.

DARTFORD.—Houses, Carleton Road, for the Devonshire Building and Investment Co., Ltd.; shop, Station Approach, for J. Levaillant.

DEAL.—Houses, Harold Road, G. H. Denne & Son, builders, 7A, Queen Street, Deal; Grange Road, A. W. Thompson, builder, Cambridge Road, Lower Walmer.

DENTON.—Two new Council schools. Lancashire County Council Education Committee.

DEVONPORT.—Proposed new municipal buildings (£60,000). E. J. Fittall, Town Clerk.

DEWSBURY.—Extension of the Dewsbury Technical School (£2,000).

DONCASTER.—Proposed hippodrome, Printing Office Street, for J. W. Chapman, Grand Theatre.

DUDLEY.—Important additions to the Post Office for H.M. Office of Works (£6,500).

DURHAM.—Houses, Anton Stile, for G. Innes; Bowburn, for Robert Bambling.

DUFFIELD (Derbyshire).—Sewage works (£2,000). Belper Rural Council.

EASINGTON, CASTLE EDEN (Co. Durham).—House and shop, Horden, for F. Watt; houses, Wingate, for Mr. Cook and Mr. Hayes; Haswell, for Mr. Craggs.

EASTBOURNE.—Alterations and additions to 261-3, Seaside, for Baker and White; three pairs of houses, Prentice Road, for Miller and Selmes; additions to premises and petrol store, Bakers's Road, for H. R. Leach; seven houses, Green Street, for A. Avard.

ECCLES (Lancs.).—Houses, Kirkman Avenue, Barton, for J. E. Owen; Cecil Street, for J. Nevitt; Parrin Lane, Winton, for J. W. Willoughby.

EDINBURGH.—Seven houses at Laughton Hall, for J. Duncan; six houses at Seaview, Joppa, for J. Scott.

ELLESMERE PORT (near Birkenhead).—Houses, King Street, for Mr. Warrington; offices, Westminster Road, for W. H. Wilson.

ELY.—High School for Girls, at March (£4,000). Isle of Ely Education Committee.

EPSOM.—Extension of the Girls' Home, for the Board of Guardians. A. C. Williams, architect.

Residence, The Downs, for Mr. Ropenhagen.

Eight houses for T. Hersey, cycle and motor works, Epsom.

ESTON (Yorks.).—Church hall (accommodate 250).

FALKIRK.—Proposed public baths in Graham's Road, for the T.C.

FERNDALE (Glam.).—Structural alterations to the Tudor Hall, for Dr. Walford Bodie.

FOLKESTONE.—Adaption of the Harveian Institute for a Hippodrome, under consideration.

FLEETWOOD.—Proposed secondary school. Secretary Higher Education Committee, Fleetwood.

GLASGOW.—School at corner of Victoria Drive and proposed new street in Scotstoun. Clerk to the Renfrew Landward School Board, Renfrew.

Observation block at the Reechill Fever Hospital. City Engineer.

(Yoker).—Seven tenements of houses in Dumbarton Road, for D. Macbeth, 74, Bath Street, Glasgow.

(Giffnock).—Thirteen houses in new street off Park Road.

Four tenements of houses at corner of Dumbarton Road and proposed new street in Scotstoun (West). W. Pollock, Meadowfleet, Renfrew.

Workshop in Hobden Street, Springburn. A. and J. Main & Co., Ltd.

GLOUCESTER.—Alterations and repairs to the Palace Theatre for Messrs. Poole.

GLYN NEATH.—One dwelling house at Cwmgwrach. J. Ll. Smith, M.S.A., Aberdare.

GREAT HARWOOD.—Central premises for the Great Harwood Co-operative Society (electric power and lighting installation included) (£9,000).

GRIMSBY.—Primitive Methodist Sunday schools in Stortford Street (£1,300).

GUILDFORD.—Buildings over pumping plant (£1,700). C. G. Mason, surveyor to Town Council.

HADDINGTON.—Post Office in Court Street. W. Black & Sons, contractors, 150, Dundee Street, Edinburgh.

HALIFAX.—Extensions to shops in Piece Hall, for the T.C. J. Lord, borough engineer.

HALTWHISTLE.—Church Hall. A. Hardgrave, architect.

HARLECH (North Wales).—New schoolroom and house at Las Ynys. O. M. Roberts & Son, architects, Portmadoc.

HARMONDSWORTH (Middlesex).—Alterations to old Council school (£416). S. Bateman, builder, Harmondsworth.

HAROLD WOOD (Essex).—Proposed fever hospital for the West Ham Council.

HARROGATE.—Additions to residence. Fred Rowntree, architect, 11, Hammersmith Terrace, London, W.

HEBDEN BRIDGE.—Semi-detached villas, Savile Estate. W. Wrigley, architect, St. George's Square, Hebden Bridge.

(Charlestown).—Assembly hall and school. Sutcliffe & Sutcliffe, architects, New Road, Hebden Bridge.

HEXHAM.—Secondary school (accommodate 240) for the C.C.

HIGH WYCOMBE.—Chair factory in Newland Meadows for C. Smith.

HITCHIN.—Houses, corner of King and Alexandra Road, for W. Pearmain Nuns Close, for J. Knight.

HOLYHEAD.—Additions to the County School, for the Governors. J. Owen, architect, Exchange Buildings, Holyhead.

HONLEY (Yorks.)—Houses, Long Lane, for A. Hirst & Co.; New Mill Road, for A. Lodge; shop and warehouse, Woodhouse Road, for D. Kinder.

HOUNSLOW.—Music hall on site adjoining King's Arms Hotel.

HOVE.—Theatre in Holland Road. E. Runtz, architect, 10, Walbrook, London, E.C.

HUDDERSFIELD.—Alterations (including electrical work) to premises in Market Place, for W. H. Smith & Son. J. B. Abbey & Son, architects, 34A, New Street, Huddersfield.

Proposed alterations and additions at the tramways depôt, Great Northern Street. Town Clerk, Town Hall, Huddersfield.

HULL.—Houses, Marlborough Avenue, for G. E. Kirkwood; Faraday Street, for G. Kennington; Exmouth Street, for J. E. Wray; Exmouth Street and New Street, for F. Neal; Westcott Street and New Street, for Atkinson & Trotter; Portobello Street, for Mrs. L. Charles; Exmouth Street and Ventnor Street, for J. Franklin; Wellesley Avenue, for G. Garbutt; Portobello Street, for G. B. Cheeseman; Haddon Street, Daulton & Stebbings, builders, 163, Boulevard, Hull; new premises, Jarratt Street, for the Hull Brewery Co., Ltd.; flour mill, Clarence Street, for J. Rank, Ltd.; business premises, Craven Street, for Kirkpatrick & Co.

GELLIGAER.—Houses, Ystrad Mynach, for Geo. Davies; Bargoed, Geo. Barnett, builder; Deri, for David Williams; Bargold, for A. Jones.

ILFRACOMBE.—Rebuilding shop and dwelling-house in 78, Fore Street H. W. Weir, Greenclose Road, Ilfracombe.

INVERURIE.—Higher Grade School (£5,000). Rev. J. Black, chairman of the School Board.

JARROW.—Bakery for the Jarrow & Hebburn Co-operative Society, Ltd. W. D. Graham, secretary to the society, Birch Street, Jarrow.

KEARSLEY (near BOLTON).—Two houses, Lord Street. Messrs. Seddon.

KENDAL.—Additions to residence for H. B. Armistead. S. Shaw, architect, Kendal.

KILLALOE.—Additions of 35 rooms to Lake Side Hotel.

KINGSTOWN (Co. DUBLIN).—Dispensary and caretaker's residence in Patrick Street, for the Rathdown Board of Guardians.

KIRKCALDY.—Proposed small-pox hospital for the Fife C.C.

KNUTSFORD.—Alterations and additions to Nether Tabley Schools for Cheshire C.C. H. Beswick, county architect, Newgate Street, Chester.

KYLE.—Alterations and additions to the Union Poorhouse (£15,000). Kyle Union Poorhouse Board.

LANCASTER.—Houses and shop, Newsham Place, for Crook & Linthwaite; houses, Railway Street, for Reuben Baines; Sibsey Street, for Mr. Cooper; Westbourne Road, for R. Whiteside; Newsham Place, for Jas. Lockhart.

LEEDS (HEADINGLEY).—Pair of villas. C. H. Brooke, architect, 7, Cookridge Street, Leeds.

Roman Catholic Church (St. Augustine's) in Harehills Lane. J. Priestley, architect, Leeds.

LEITH.—Flatted villas in Clarebank Crescent. Leslie & Millar.

LEIGH (SOUTH LANCS).—New spinning mill. Taylor Bros., contractors, Littleborough.

LEIGH-ON-SEA.—Proposed Masonic Temple.

LEVENSHULME (LANCS.).—School for the District Council.

LITTLE HULTON.—Villas in Hilton Lane. G. T. Gibson, builder, Walkden.

LIMERICK.—Restoration and renovation of St. Michael's Church.

LIVERPOOL.—Commercial buildings on George's Dock site, Pier Head. W Aubrey Thomas, architect, 14, Dale Street, Liverpool.

Welsh Wesleyan Church (£2,500). Richard Owen & Son, architects, Liverpool; J. & G. Chappell, builders, County Road, Walton.

(WALTON).—Parish Hall in Goddison and Gwladis Streets in connection with the Church of St. Luke the Evangelist (£2,000). J. H. Havelock-Sutton, architect, Formby and Liverpool; Haugh & Pilling, contractors, Liverpool.

LONDON (S.E.).—Technical Institute for the L.C.C.

(BERMONDSEY, S.E.).—Additions to shop in Artillery Street. W. E. Hill & Son, 48, Borough High Street, S.E., builders.

(BERMONDSEY, S.E.).—Factory for R. Blackie, manufacturing chemist. Barlow & Roberts, 14, Red Cross Street, S.E., builders.

(BERMONDSEY, S.E.).—Rebuilding "Yorkshire Grey" public house. L. Whitehead & Co., Clapham Road, S.E., builders.

(SOUTHFIELD, S.W.).—Five houses and stable. Woodley Bros., Woodhouse, Wimbledon Road, Tooting Graveney, S.W.

(KENSINGTON HIGH STREET, W.).—Shops. Ashby Bros., builders, 6, Union Court, Old Broad Street, E.C.

(FULHAM, S.W.).—Factory buildings in Wyfold Road. J. A. J. Keynes, architect, 60-4, Brompton Road, S.W.

(CATFORD, S.E.).—Development of Forster Estate. J. Everington, 31, Bromley Road, Catford, S.E.

(STEPNEY, E.).—Building on site of 40, Artillery Lane. W. A. Lewis, architect, 11-12, Finsbury Square E.C.

(SHADWELL, E.).—Building for J. Smith & Co., 290-2, Cable Street, E., tarpaulin manufacturer.

(SOUTHFIELD, S.W.).—House, Bective Road. S. S. Witton, builder, 148, Upper Richmond Road, Putney, S.W.

(STREATHAM, S.W.).—Twelve houses in Becmead Avenue. Holliday & Stanger, agents, 227, Streatham High Road, S.W.

(BALHAM S.W.).—Laundry and mortuary at Home for Aged Jews. G. W. Beale, builder, 505A, Cambridge Road, N.E.

(ALDGATE, E.).—New school building (£24,000). A. W. Cooksey, architect, 6, Adam Street, W.C.

(CITY).—Rebuilding Nos. 35 and 36, Aldermanbury (partially destroyed by fire) for S. Guiterman & Co., Ltd., American merchants.

(BETHNAL GREEN, N.E.).—Alterations, &c., to Teesdale Street School (£8,967). W. Johnson & Co., Ltd., builders, Wandsworth Common, S.W.

(WALTHAMSTOW, N.E.).—Four houses in Hillcrest Road. A. Attwell, Walthamstow.

(BETHNAL GREEN, N.E.).—Alterations, &c., to Pritchard's Road School (£4,957). T. J. Bailey, Education Architect L.C.C., Spring Gardens, S.W.

(HACKNEY, N.E.).—Improvements, &c., to Tottenham Road Mixed School (£5,654). Perry & Co., builders, Tredegar Works, Bow, E.

(ST. PANCRAS, N.W.).—Improvements at Aldenham Street School for L.C.C. (£10,708). E. Lawrance & Sons, builders, Wharf Road, City Road, E.C.

(WANDSWORTH, S.W.).—Operating room at Infirmary (£290). General Building Co., 62, St. Martin's Lane, W.C.

(HENDON, N.W.).—Four houses in Radnor Road. F. and W. Beitesworth, builders, 15 and 16, Hindes Road, Harrow.

DEPTFORD, S.E.).—Premises for National Telephone Co. C. P. Roberts & Co., builders, 138, St. Paul's Road, N.

(TOTTENHAM).—Extension of Polytechnic Buildings. Treasure and Son, builders, Holloway, N.

(POPLAR, E.).—Eleven houses in Ridgdale Street. E. Evans, agent, 253, Lavender Hill, S.W.

POPLAR, E.).—Factory for Waterlow & Sons, Ltd. W. Lawrence and Sons, Ltd., builders, Canal Works, Waltham Cross.

LEYTON, N.E.).—Additional accommodation at Town Hall (£8,600). Newman & Jacques, architects, 2, Fen Court, Fenchurch Street, E.C.

W.).—Shops, &c., corner of Edgware Road and Maida Hill West. F. W. Foster, architect, 41, Bedford Row, W.C.

(LEYTON, N.E.).—Factory in Church Road. A. W. Hudson, architect, 87, Finsbury Pavement, E.C.

(LEYTON, N.E.).—Two Vicarages. Mattock & Parsons, builders, 165, Gray's Inn Road, W.C.

(LEYTON, N.E.).—Additions, Holy Trinity Church. W. J. Maddison, builder, St. Joseph's R.C. School, Highgate, N.

(LEYTON, N.E.).—Seven houses, Dames Road. R. M. Banks, architect, 121, Plashet Grove, Upton Park, E.

(LEYTON, N.E.).—Five houses, Hainault Road. R. Grimes, builder, 83 Wallwood Road, Leytonstone.

(WALTHAMSTOW, N.E.).—Parish Hall in Shernhall Street. W. A. Lewis, architect, 11-12, Finsbury Square, E.C.

(WALTHAMSTOW, E.).—Three houses, Woodstock Road. W. Silk and Son, builders, 13, High Street, Homerton.

WALTHAMSTOW, E.).—Class-rooms in Church Hill Road. C. W. Hodgson, architect, 153, St. John's Road, Walthamstow.

LEWISHAM, S.E.).—Two houses, Baring Road. A. Durbin, builder, Grove Park, S.E.

LEWISHAM, S.E.).—Twelve houses, Muirkirk Road. Norfolk and Prior, architects, Catford.

PADDINGTON, W.).—Building, Irongate Wharf Road. Forsyth and Maule, architects, 16, Great Marlboro' Street, W.

LONDON (WANDSWORTH, S.W.).—Sunday School at Magdalen Road Baptist Church, Springfield.

LONLAS (GLAM.).—School for the Glamorgan Education Committee (£5,282) D. W. Davies, builder.

LONGPORT.—New classrooms at Huish Episcopi. Mr. Pittard, Longport.

LOWER BEBINGTON.—Stables and depôt buildings at New Ferry for the U.D.C. Surveyor to the U.D.C., Lower Bebington.

LUTON.—Houses at Leagrave, for Mr. Horsfell and R. Andrews; houses, Hitchin Road, Chas. Abrahams, builder, Wynch House, High Town Road, Luton; Naseby Road, for T. Day; Martley Road, for J. Tompkins; Ridgeway Road, for Arthur Cole, builder, 183, High Town Road; Clipstone Road, for J. Frost; New Bedford Road, for W. Davis; Ashburnham Road, for G. W. Pryer, builder; Downs Road, West Hill Road, for W. Smith; Reginald Street, for Geo. Kingham, builder, 106, Old Bedford Road Cromwell Road, for W. G. Dunham, builder, 20, Guildford Street.

LYDBROOK (GLOS.).—Proposed school for the Gloucestershire Education Committee.

MAIDSTONE.—Houses, Bower Mount Road, Clarke & Epps, builders, Cornwallis Road, Maidstone; Sheal's Crescent, W. T. Burrow, builder, 27, Hedley Street, Maidstone; extensions to Eiffel Tower Factory, for G. Foster, Clark & Co.

MANCHESTER.—*City News* Offices, Strutt Street, to be rebuilt; new premises Brown Street and Norfolk Streets, for the Palatine Bank, Ltd.; new shops, Mosley Street, for Lewis's, Market Street; building at Clarendon Road Municipal School, Crumpsall; municipal secondary school for girls in Whitworth Street (£88,000) buildings at destructor works, for the Corporation.

Warehouses, shops, and offices in Mosley Street and Piccadilly. J. W. Beaumont & Sons, 10, St. James's Square, Manchester.

Additions to the Education Offices, Deansgate. W. H. Talbot, Town Clerk, Town Hall, Manchester.

(MOSSLEY).—Houses, Mountain Street, for the Mossley Co-operative Society. John Eaton, Sons & Cantrell, architects, Stamford Street, Ashton-under-Lyne.

MANSFIELD (STANTON HILL).—Schools and class-rooms in connection with the Primitive Methodist Chapel (£1,000).

MARKET HARBOROUGH.—Rebuilding premises for the Co-operative Industrial Society, Ltd. Coales & Johnson, architects, Market Harborough.

MERRIOTT (SOMERSET).—Additions to schools (£278). F. R. Bartlett, Yeovil.

MERTHYR.—Library, museum, police court, swimming baths, &c., under consideration. Borough engineer.

MIDDLESBROUGH.—Proposed secondary school in Orchard Road, Linthorpe (£7,000). Secretary, Middlesbrough Education Committee.

Conversion of 17 houses into shops. S. I. Wiggen, Abinger House, Abinger Road, Bedford Park, London, W.

MIRFIELD.—Houses, Greenside, for D. E. Swithenbank; St. Paul's Road, for Miss H. S. Waddington; Northorpe, for Leonard Carter.

MITCHAM.—Houses, Boscombe Road, for G. S. Cook; Church Road, for G. Neal; nine shops, London Road, for J. W. Hallett.

NANTWICH.—New Council school in Beam Street. Surveyor, Council Offices, Nantwich.

NEWMARKET.—Stables and coal wharf. Local Co-operative Society.

NELSON (GLAM.).—Additions and alterations to St. John's Church. E. M. Bruce Vaughan, architect, Cardiff.

NEWPORT (MON.).—Presbyterian Sunday schools (£1,600). John Jenkins, Ltd. builders, Newport.

NOTTINGHAM.—Proposed extension of the city asylum. City architect

OLDHAM (FAILSWORTH).—Mission hall. Mr. Montfield, architect, Warrington Thos. Whitehead, builder, Failsworth.

OXTED (SURREY).—Proposed public institute (£2,500)

PARTICK.—Church in Broomhill Drive. Stewart & Paterson, architects, 14, Blythswood Square, Glasgow.

PATRICROFT (near MANCHESTER).—Concert pavilion, 552, Liverpool Road, Peel Green, for H. O. Gates.

PENTRE (RHONDDA).—Repairs and alterations to the Tivoli Palace and Hippodrome for Messrs. Poole.

PONTYCYMMER (BRIDGEND).—Structural alterations to the Public Hall for Dr. Walford Bodie.

PORTADOWN.—Additions and alterations to the Orange Hall. J. W. Walley, architects, Portadown.

PORTH (RHONDDA).—Alterations and repairs to the Palace Theatre for Messrs. Poole.

PORTSMOUTH.—Police station at Eastney, to be lit by electricity, for the T.C. (£1,400).

PRESTON.—Enlargement of Whittingham Lunatic Asylum, for the Lancashire Asylums Board.

(HOWICK).—Primitive Methodist School-Chapel for the Longton and Howick district (£800). Mr. Henshaw, architect, Blackburn; J. Johnson, builder, Longton, Preston.

PUDSEY.—Presbytery for St. Joseph's R.C. Church; offices for Jowett, Kendal and Sons, South Parade, Pudsey.

READING (WHITLEY).—Council School (Reading Whitley Special School) in Northumberland Avenue, Whitley. W. R. Howell, architect, Blagrave Street, Reading.

RIPON.—Secondary School for Girls (£5,200). Connor and Chorley, architects, Leeds; Wm. Airey & Son, builders, Servia Road, Leeds.

ROCHDALE.—Police station, Spotland Bridge, for the T.C. W. H. Ashworth builder, Deeplish, Rochdale.

ROTHERHAM.—Pair semi-detached houses, T. and T. W. Reading, Ewers Road, Kimberworth, Rotherham; eight dwelling houses, South Street, Kimberworth, S. L. Frugone, builder, Rotherham; ten dwelling houses, St. Ann's Road, Charles Green's Sons, Wellgate, Rotherham; pair semi-detached villas, Broom Road, Wm. Thornton, builder, Rotherham; pair semi-detached villas, Kimberworth Road, W. Twigg, Kimberworth Road Rotherham; pair semi-detached villas, Kimberworth Road, A. Hart, Kimberworth Road, Rotherham.

ROWLEY REGIS.—Additions to Blackheath Schools. J. Bridgwater, builder Cradley Heath.

RUGBY.—Alterations and additions to premises in Railway Terrace for C. H. Patchett.

RYTON (Co. DURHAM).—Wesleyan Church at Clara Vale. T. E. Davidson and Sons, architects, Pearl Buildings, Newcastle-on-Tyne.

ST. AUSTELL.—Houses, Station Road, St. Blazey, for W. C. Puckney Caerhays, for J. C. Williams, Caerhays Castle; Ranleigh Road, Mount Charles, for J. Mably; pavilion, St. Blazey, for J. Campbell.

ST. HELENS.—Houses, Gladstone Street, for R. Ellison, builder, Windle Street.

SCORTON (DARLINGTON).—Wesleyan Methodist chapel (£900).

SEAHAM COLLIERY (Co. DURHAM).—Houses for Mr. Mason and Clark and Son.

SEDGLEY (DUDLEY).—Premises, near the Bull Ring, for the United Counties Banking Co.

SHEFFIELD.—Extension of wagon repairing shed at Brightside for the Midland Railway. Secretary of the Way and Works Committee, Midland Railway, Derby.

SHEERNESS.—Proposed new school at Sheerness East (accomodate 200).
SHILDON (Co. Durham).—Institute for workmen for the North-Eastern Railway Co. Wm. Bell, architect to the company, York.
SHIPLEY (Yorks.).—Houses, Moorhead Lane, for A. Kendall & Sons; Marlborough Road, for Walter Baxter.
SLOUGH.—Manual Instruction and Cookery Centre for Bucks C.C. C. G. Watkins, Education Offices, Aylesbury.
SOUTHEND-ON-SEA.—Proposed Masonic Temple (£2,500). H. Harris, architect.
STAINES.—Enlargement of Council School. T. J. Hawkins & Co., builders Victoria Street, Westminster, S.W.
STOCKTON (Rugby).—Schools. Messrs. Hollowell, builders, Rugby.
STOKE-ON-TRENT.—Workshop and store-room, The Mount, for the North Staffs Joint School Authority; Sunday Schools, Woodhouse Street, for the Trustees of the Primitive Methodist Church.
Houses, Daintry Street. W. Ball, builder, 190, Oak Hill Villas, London Road, Stoke.
STROUD.—Church at Uplands (£6,000). Rev. J. Bevan, vicar.
SUTTON (Surrey).—Additions to Crown Road Schools. J. B. Potter, builder, Carshalton Road, Sutton.
THIRSK (Yorks.).—Wesleyan Church at Cold Kirby.
TIPTON.—New factory, Horseley Heath, for W. W. Doughty, C.C.
TONYREFAIL (South Wales).—Thirty houses at Thomastown, Tonyrefail. J. Jones, architect, Tonyrefail, Glam.
TUNSTALL.—Enlargement (accommodate 200) of St. Mary's Church of England Schools. Managers.
WALLINGTON (Surrey).—Houses, Spencer Road, for J. J. Cooper; Harcourt Road, John White, builder, Wallington; Hall Road, for A. J. Morris.
WALSALL.—Men's day-room, and dormitories under consideration (£3,600). Board of Guardians.
WARE.—Houses, Broomfield Wood, Standon, for F. Howard; Hailey Lane, Great Amwell, for H. W. Green, Bengeo.
WATFORD.—New theatre and Hippodrome.
WELWYN (Herts).—House at High Welwyn for Powell & Co.
WEYBRIDGE (Surrey).—New Post Office.
WEST HARTLEPOOL.—Sawmill and premises. W. Young, Park Road, West Hartlepool.
WESTON-SUPER-MARE.—Place of Worship (£5,000). Wilde & Fry, architects, Weston-super-Mare; Chas. Addicott, builder, Stanley House, Locking Road, Weston-super-Mare.
Primitive Methodist school-chapel in Brighton Road.
WHEELTON (near Chorley).—House in Blackburn Road, H. Parminter; additions to Euston Vicarage, near Chorley.
WHITBY.—Residence in Grosmount Road, Sleights, for Mrs. I. C. Kirkaldy, Woodford, Essex.
WIGAN.—Workshop in Frog Lane, J. Wood & Sons, Ltd.; motor garage, Arcade Street, H. B. Timperlake; dairy for the Wigan and District Equitable Co-operative Society, Ltd., Standishgate, Wigan; house, Darlington Street, for J. P. Heyes, veterinary surgeon.
WILFORD (near Nottingham).—Almshouses (£5,000). Gift of Mr. Jesse Boot.
WOLVERHAMPTON.—New Factory, Retreat Street, for Messrs. Southan, clothing manufacturers.
WORTHING.—Houses in Alexandra Road, for F. A. Moat, J. E. Lund, Worthing, architect; dwelling houses and shops in Montague Street, for G. Goodall, H. M. Potter, architect; house in Cissbury Road, Broadwater, for F. Sandell & Sons, builders, Worthing; houses in Woodleigh Road, West Tarring, for E. H. King, builder, Worthing.
WORCESTER.—School at Cradley Colley Lane for the Worcester Education Committee. Pritchard & Pritchard, architects, Kidderminster.
YORK.—Additions to St. Olave's Church, Marygate, J. F. Doyle; four houses, Albermarle Road, W. Walls; Albermarle Road, for J. W. Cooper; Mission room, Yarburgh Street, for Rev. J. Topham; secondary school for girls in Sycamore Terrace for the York Education Committee.

FORTHCOMING EVENTS.

Tuesday, June 9th.—At 8 p.m. At the Institution of Electrical Engineers. Faraday Society. Paper on "The Utilisation of Atmospheric Nitrogen in the Production of Calcium Cyanamide, and its Use in Agriculture and Chemistry," by Dr. A. R. Frank.
Wednesday, June 10th.—At 2.30 p.m. At the Institution of Mechanical Engineers, Storey's Gate, Westminster. Institute of Metals. Inaugural meeting.
Friday, June 12th.—At 8 p.m. At the Royal College of Science, South Kensington, S.W. Physical Society. Special general meeting, followed by papers on "Experiments on a Directive System of Wireless Telegraphy," by Messrs. Bellini and Tosi; "The Resistance of a Conductor of Uniform Thickness whose Breadth Suddenly Changes, and on the Shapes of the Stream Lines," by Prof. Lees; "The Self-Inductance of Two Parallel Wires," by Dr. Nicholson; "Homogeneous Secondary Radiation," by Dr. Barkla and Mr. Sadler.

Electricity in Gold Mines.—An important adjunct to the successful working of the gold mines in the Cripple Creek district of Colorado, is the application of electricity to hoisting and other machinery. It is understood that no fewer than 40 hoists, operated by electricity furnished by the local power company, are scattered throughout the district. A large number of these hoists are on mines that are being worked by small lessees, who under ordinary conditions could not make the good showing in output that they are doing at present. The better managed of the larger mining companies utilise electricity for driving compressors, which in turn operate a multitude of drills. In short, electricity is being employed wherever convenient for both light and power, and the working cost sheets of the mines and mills testify to the wisdom of this policy.—*American Mining World.*

Hove Rifle Range.—The employés of the Hove electricity works opened a miniature rifle range at their works in Prinsep Road on May 22nd.

NOTES.

Our Annual Tables.—These are now in the press; we shall be glad to receive latest corrections and data as soon as possible.

Accident at Hebburn.—A serious accident occurred on May 29th in connection with the tunnel which is being sunk under the Tyne, between Wallsend and Hebburn, to carry electric cables from the Carville station of the Newcastle-on-Tyne Electric Supply Co. to the south side of the river. The scheme, which is estimated to cost about £20,000, was devised to facilitate the supply of energy to Durham county. The County of Durham Electrical Power Distribution Co. take a bulk supply from the Newcastle company, and at present the cables are carried from Carville to the High-Level Bridge at Newcastle, and thence across the river. The length of these cables in the future would have to be 20,120 yards, whereas the distance by the tunnel will only be 1,160 yards—a saving of 18,960 yards. The contractors for the work are Messrs. Robert McAlpine & Sons, Glasgow. The shaft to the tunnel on the north side has been completed, and is about 130 ft. deep. The southern shaft is being constructed at Messrs. Robert Stephenson and Co.'s shipyard at Hebburn, and a depth of about 80 ft. has been reached. The sinking operations there have proceeded successfully and expeditiously, although the work has been difficult, and it is stated that lately some trouble had been experienced with water. On the morning of May 29th the night-shift men had ascended the shaft and the day-shift men were descending, when an explosion occurred. A man named James Reilly, of Hebburn, had apparently reached the bottom of the shaft, and three others were in a caisson ready to be lowered, when the explosion took place. The cylinder, caisson, and the heavy baulks of timber used to shore the sides of the shaft were forced upwards. The three men were thrown to the top of the caisson and injured, while Reilly's body could not be recovered owing to the inrush of water, and it was not expected to be reached for several days.

Electric Shock Fatalities.—Edward King, 46, described as a battery man, while engaged in the test room at the telegraph works of Messrs. Siemens Bros. at Woolwich on Wednesday last week, received a fatal shock at from 6,000 to 10,000 volts. Deceased had been employed at the works for eight or nine years. While a test was in progress he, according to reports, removed a board and entered the danger zone to fetch a coil of wire. Apparently he fell, and his head came into contact with a live wire. Death was instantaneous. At the inquest the foreman of the jury said that evidently use had led King to neglect the usual precautions. A verdict of "Accidental death" was returned.

Nobi Bux, a bricklayer's labourer, at the Sealdah Railway Station (India), received a shock from an electric wire while engaged on a scaffold. He clutched at another electric wire to save himself from falling, and received a second shock, and when taken down he died immediately. His hands and legs, according to the *Indian Daily News*, were horribly burned.

Electrical Contractors' Association (Liverpool Branch).—On May 12th this branch held its annual general meeting at the Stork Hotel, an informal social and smoking concert following. The company present included practically the whole of the members of the Branch, together with a number of contractors, non-members of the Association, who had been specially invited to attend the meeting. The officers of the Branch were elected as follows: Chairman, Mr. W. Sutton; Hon. Sec., Mr. G. J. Harford, A.M.I.E.E.; Hon. Auditors, Mr. C. R. Whipple, A.M.I.E.E., and Mr. W. M. Herd; Delegates to Northern Section, Mr. G. J. Harford and Mr. W. Sutton; Hon. Solicitor, Mr. Ross. Upon the presentation of the balance-sheet, the committee was congratulated on the satisfactory state of the finances of the Branch. The secretary, in reporting the progress of the Branch for the year, stated that the attendance at the monthly meetings had been very good, and the benefits received by the members through the help of the Association had been considerable. He also instanced the good work done by the Association in connection with municipal trading, the Cable-Makers' agreement and other matters. Subsequently a paper was read by Mr. F. L. Monkhouse, M.I.E.E., on "The Progress of Incandescent Lamps." A lively discussion followed, in which Messrs. W. Sutton, C. P. L. Titherly, G. J. Harford, C. R. Whipple, W. G. Bucknall and Watson took part.

It was felt that the meeting was the commencement of a new progressive era in the life of the branch. It was decided to hold all future meetings in the evening. A paper will be read at each meeting, to be followed by a discussion by the members. Mr. Watson, of Messrs. John Hunter & Co., members of the branch, will read a paper on "Electro-Medical Apparatus" at the next meeting.

American Electrical Official Murdered.—During the annual Convention of the National Electric Light Association in Chicago, the week before last, Mr. Robert C. P. Holmes, purchasing agent of the Commonwealth Edison Co., of Chicago, was robbed and murdered. He was a member of the Reception Committee of the Association, and had been present at the latter's proceedings on Monday, Tuesday and Wednesday of that week. It was in the early hours of Thursday morning that his lifeless and wounded body was found in one of the side streets of the city. Mr. Holmes had been connected with the Edison Co. since 1882. The Thursday morning session of the Association was adjourned in consequence of the tragedy.

Institution and Lecture Notes.—PHYSICAL SOCIETY.—At the meeting held May 18th, 1908, a paper on "A Modified Theory of Gravitation" was read by Dr. C. V. Burton, and a paper on "An Examination of the Formulæ for the Grading of Cables" by Mr. C. S. Whitehead. In the *Journal* of the Institution of Electrical Engineers both Mr. O'Gorman and Mr. Russell have shown that it would be advantageous if cables for electric lighting were constructed so that the component of the electric intensity along a radius (in cylindrical co-ordinates) was kept constant for all points in the dielectric in the same plane perpendicular to the axis. They both find that to attain this object λr ought to be kept constant if the current is alternating, and σ/r constant if the current is steady, where λ is the specific inductive capacity, σ the specific resistance, and r the distance from the axis. In this paper the question is regarded from a much more general point of view. Mr. A. Russell exhibited a portion of a Jona graded cable which had successfully withstood a testing-pressure of 150 kilovolts applied between the core and the lead sheath. If the dielectric had been air, a disruptive discharge would have ensued at 23 kilovolts. A paper, entitled "Illustrations of Geometrical Optics," was read by Mr. R. M. Archer.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—The semi-annual meeting will be held in Detroit, Michigan, between June 23rd and 26th. An entire session will be devoted to papers on the conveying of materials, when hoisting and conveying machinery will be discussed. Among other subjects to be treated in papers are the following:—"Thermal Proportions of Superheated Steam," by Prof. R. C. H Hock, of Lehigh University; "Horse-power, Friction Losses and Efficiencies of Gas and Oil Engines," by Prof. Lionel S. Marks, of Harvard University.

INSTITUTION OF CIVIL ENGINEERS.—The Council proposes to award annually a prize to be called the Indian Premium, to the author, being a corporate member of the Institution in practice in India, of the best paper received during the year on a subject connected with Indian engineering. This special award is derived from the proceeds of certain trust funds conveyed to the Institution on the closing of the Royal Indian Engineering College, and will be of the value of about £33 annually. The Council has accepted a legacy of £1,000 bequeathed by the late Mr. F. W. Webb, to establish a "Webb Prize" for the best paper submitted to the Institution on "Railway Machinery."

LIVERPOOL AND DISTRICT ELECTRICAL ASSOCIATION.—The members and friends of the above Association paid a visit to Southport last Saturday afternoon. On arrival at Southport, they proceeded to the Southport Corporation Electricity Works, situated at Crowlands, where an interesting inspection of the plant was made. This outing is expected to be followed by a visit to the Pacific Steam Navigation Co's steamer *Orita* on Saturday, June 27th.

CENTRAL TECHNICAL COLLEGE.—The third-year students of this College are holding their annual dinner at the Gaiety Restaurant on Thursday, June 18th, at 7.30 punctually. All Old Centralians are cordially invited to attend. Prof. Dalby will preside. Tickets may be obtained from the hon. sec., Mr. C. H. Russell, Ingram House, Stockwell, S.W., at 7s. each.

The Murder of Mr. London.—The *Times* reports that the five natives concerned in the murder of Mr. London, electrician on the s.s. *Colonia*, were sentenced to death in the first instance, but on appeal the sentence in one case was reduced to ten years' imprisonment; they have now appealed to the Privy Council.

Arc Lamps.—CORRECTION.—In the review of Messrs. Zeidler and Lustgarten's book, published on May 22nd, p. 860, line five, for "33½" read "23½" inches.

The M.E.A. Meeting Arrangements.—Just as we go to press there comes to hand the programme of arrangements for the Nottingham meeting of the Municipal Electrical Association, which is to be held from June 30th to July 3rd. The presidential address will be delivered by Mr. H. Talbot, chief electrical engineer of Nottingham, at the University College on the morning of Tuesday, June 30th, and a paper on "The Experiences of a Convener in the Establishment of an Electricity Undertaking," by Bailie Wightman, of Govan, will follow. The rest of that day will be given up to luncheon and visits. Wednesday, July 1st, will be devoted entirely to an excursion to Dovedale. On Thursday afternoon, after the annual general meeting (which is to be held in the morning), Mr. H. Richardson, of Dundee, will read a paper on "Some Considerations on the Design of a Generating Station," and one on "The Reconstructions of an Electric Lighting Scheme" with observations on the working of a combined steam and water-power plant, by Mr. C. M. Shaw, chief electrical engineer at Worcester, will follow. The Association dinner takes place the same night at the Exchange Hall. On Friday, July 3rd, at 10 a.m., there will be two papers, thus:—"A.C. Accumulator Sub-stations," by Mr. A. M. Taylor, assistant electrical engineer, Birmingham; "The Work and Equipment of a Testing and Standardising Department," by Mr. H. A. Ratcliff, superintendent of the Testing Department, at Manchester Electricity Works. Visits to places of interest in Nottingham will occupy the rest of the day.

Tungsten Lamp Patents.—A letter appears in our "Correspondence" columns to-day on the above subject. We also observe that a letter appeared in the *Times* Engineering Section on Wednesday in regard to the same matter, the writer in this case being Mr. Reginald Belfield, of the British Westinghouse Co., Ltd. He remarks that our contemporary's report of Mr. Hirst's recent paper is likely to create a wrong impression, and continues:—"Mr. Hirst may be excused for thinking that his own particular lamp, the Osram, is the only tungsten lamp commercially practical. Readers of the previous articles which have appeared in your columns are, however, well aware that this is far from being the case. There are, in fact, many commercial and useful methods of producing tungsten filament lamps which are protected by entirely independent patents. Broadly speaking, there are four methods of producing tungsten filaments being used commercially at the present day. These are so called the 'paste' process, the 'substitution' process, the 'colloidal' process and the 'amalgam' process. Lamps are being manufactured by all these processes, and each of them has produced commercial and useful lamps. The Westinghouse Metal Filament Lamp Co., Ltd., have patented in England several separate and distinct processes for producing tungsten filaments, and have been for some time, and are now, supplying lamps to the public which, as regards the efficiency and life, compare favourably with any lamps on the market."

International Congress on Electrical Units.—An International Congress will be held in London in October next, opening on Monday the 12th, and the Board of Trade has appointed a Committee, consisting of Mr. G. R. Askwith, Sir John Gavey, Dr. R. T. Glazebrook, Major P. A. MacMahon, Major W. A. J. O'Meara, and Mr. A. P. Trotter, with Mr. M. J. Collins as secretary, to prepare a programme and make the necessary arrangements. The Congress will consider the steps to be taken to bring about agreement in the definition of electrical units and in the methods of constructing and using the electrical standards corresponding thereto, with a view to uniform legislation and administration on the part of the Governments concerned. A Memorandum setting forth the proposals to be laid before the Congress has just been published in the *Board of Trade Journal*.

Copper.—Copper maintains a fairly even tone. Stocks continue to advance, and have now reached a high figure; in England, according to Messrs. Merton's circular, 15,339 tons of standard are registered, besides 1,157 tons of furnace material. Stocks afloat are largely augmented, Australia showing an advance of 300 tons on the quantity for the end of last month. The total visible supplies reach the phenomenal figure of 31,158 tons; this approaches three times the quantity registered for the same date last year. Supplies generally are about average from North America, rather on the low side; very much down for Spain and Portugal; higher for Chile, and down slightly for Australia. The total deliveries have fallen off from the 47,004 tons of December 31st to 32,614 tons, though this is a fair average figure usually.

Electrical Storm.—On Monday evening last an exceptionally prolonged and violent electrical disturbance took place over a large area of the British Isles, doing much damage. A wireless station at Newhaven, Sussex, was struck, and the operator on duty, Mr. H. Prout, received a severe shock, while the apparatus was seriously damaged.

Appointment Vacant.—Station superintendent for the Carlisle electricity department (£130).

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station Officials.—On Tuesday, May 26th, at the Gravesend Electricity Works, MR. JOHN A. VICE was presented with a dressing-case and a pocket-book as a farewell gift from the staff, on the occasion of his leaving to take up a position as charge engineer to the Ilford U.D.C. The presentation was made by Mr. C. F. McInnes, the chief engineer.

General.—At the opening installation of the Bikanir Road lighting on May 1st, 1908, by His Highness the Maharajah of Gwalior, His Highness the Maharajah of Bikanir, after a few words of congratulation on the success of his work during the last year, presented the electrical engineer, MR. G. R. DRUMMOND, with a valuable gold watch as a mark of his esteem. Mr. Drummond has been in the service of the Bikanir Government since July 1st, 1904, and has prepared and carried out a H.T. three-phase transmission scheme for power and lighting; the generating station with two of the sub-stations was formally opened in November of 1906 by Her Excellency Lady Minto. We understand that Mr. Drummond—his first agreement being nearly completed—has entered into a longer agreement with the Bikanir Durbar at the personal wish of the Maharajah.

Major the HON. W. L. BAGOT recently arrived at Johannesburg to take over the local managership of the Victoria Falls Power Co.

MR. COLIN L. SIMPSON, who has been secretary to the Cape Town branch of Siemens, Ltd., for the last three years, left Cape Town on May 12th to take up the managership of Messrs. Arthur Koppel, Ltd., agents for Siemens, Ltd., at Delagoa Bay.

A new electrical department has recently been created under the Bengal Government, called the Electrical Division, Public Works Department, and MR. A. K. TAYLOR, the Electrical Inspector, has been promoted to the post of executive engineer, retaining, at the same time, his old post as Electrical Inspector under the Indian Electricity Act.

Obituary.—The death took place on Sunday of MR. EDWD. THOS. PUGH (61), chief traffic assistant in the service of the Liverpool Corporation Tramways. He had had 22 years' service.

The death is announced at the age of 58 years, of MR. HENRY WEST, who took up electrical contracting work at Taunton many years ago. He retired from business in favour of his son several years ago.

NEW COMPANIES REGISTERED.

Oxford Tramways Syndicate, Ltd. (98,054).—This company was registered on May 21st, with a capital of £55,000 in £1 shares, to adopt an agreement with the City of Oxford Electric Tramways, Ltd., to acquire, hold or deal with any stocks, bonds, debentures, shares or securities in the said company or any other company formed for the purpose of constructing, financing or working all or any of the tramways authorised by the Oxford and District Tramways Act, 1907, and to carry on the business of railway and tramway owners, electric light and power suppliers, electrical engineers, metal workers, contractors for the supply of electrical plant, manufacturers of, and dealers in, apparatus used in connection with the generation, distribution, accumulation and employment of electricity, &c. The subscribers (with one share each) are:—W. J. Park, 43, Devonshire Street, Islington, N., clerk; P. R. Reeves, 42, Crediton Road, Kensal Rise, N.W., shorthand writer; S. Jordan, 115, Elm Park Mansions, Chelsea, gentleman; A. W. R. Stuart, 4, College Street, Barnsbury, accountant; C. J. Lissenden, 53, Endwell Road, Brockley, S.E., gentleman; W. Eacott, 29, Powell Road, Clapton, N.E., gentleman; R. Bott, 36, Southcote Road, Woodside, S.E., gentleman. No initial public issue. The number of directors is to be four; two to be appointed by the National Electric Construction Co., Ltd., and the remaining two by the City of Oxford and District Tramways Co., Ltd.; the first are B. Bernheim, 41, Lansdowne Road, Kensington; and W. B. Connie, 4, Queen Anne's Chambers, Westminster, appointees of the Construction Co.; and Sir Robert Buckell, of Oxford, and Col. R. F. Webb, 6, West Cromwell Road, Kensington (appointees of the said Tramway Co.). Registered office, Queen Anne's Chambers, Westminster.

Grasse and Cannes Electric Tramways Syndicate, Ltd. (98,071).—This company was registered on May 22nd, with a capital of £2,100 in 2,000 ordinary "A" shares of £1 each and 2,000 deferred "B" shares of 1s. each, to construct, lease or acquire tramways and light railways in France or elsewhere, to equip, maintain and work the same by electricity or other power, &c. The subscribers (with one "A" share each) are:—H. R. Green, 100, Lansdowne Road, Bayswater, gentleman; A. H. Chifferell, 37, Cursitor Street, E.C., printer; A. B. Bose, 13, Yale Court, West Hampstead, gentleman; C. Orchard, 71, Dollis Park, Finchley, works manager; E. E. Johnson, 70, Culford Road, Downham Road, N., book-keeper; G. Jackson, 3, Bemstead Road, Walthamstow, clerk; H. W. Newman, 76, Roslyn Road, Tottenham, clerk. No initial public issue. Registered without articles of association by Lumley and Lumley, 37, Conduit Street, W.

Bradninch and District Electric Supply Co., Ltd. (98,024).—This company was registered on May 20th, with a capital of £2,000 in £1 shares, to carry on at Bradninch and elsewhere in Devonshire the business of an electric light company in all its branches. The subscribers (with one share each) are:—D. K. Muir, Earlsland, Bradninch, surgeon; J. P. Hepburn, Bradninch, paper maker; J. Horsburgh, Bradninch, paper maker; W. A. Nicks, Bradninch, builder; H. C. Nicks, Bradninch, builder; W. Baker, Bradninch, schoolmaster; F. W. Cuming, Bradninch, farmer. No initial public issue; registered without articles of association. Registered office, Kensham, Bradninch, Devon.

Rex Electric and General Supplies, Ltd. (98,090).—This company was registered on May 23rd, with a capital of £3,000 in £1 shares, to carry on the business of electrical and general engineers, contractors, manufacturers of electrical and mechanical appliances for lighting, power and traction, importers and exporters of economic, domestic, scientific, curative and pastime electrical appliances, dealers in electrical goods and accessories, &c., to acquire the goodwill of the wholesale electrical supply department of D. Santoni & Co. (1906), Ltd., formerly carried on at 15—17, Beauchamp Street, Brooke Street, E.C., and to adopt an agreement with D. Santoni. The subscribers (with one share each) are:—D. Santoni, 10, Coburg Place, Hyde Park, W., electrical engineer; F. Welti, 23, Howland Street, W., merchant; W. Harbutt, 62, Hemingford Road, N., salesman; J. Mortimer, South Court, Thames Bank, Kingston, accountant; R. Muirhead, 20, Bloomsbury Square, W.C., gentleman; L. Gros, 31, Colvile Gardens, Bayswater, W., gentleman; A. Brown, 1, Coville Square, W., gentleman. No initial public issue. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification, £1; remuneration, £25 each per annum (chairman £75).

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Mann, Egerton & Co., Ltd. (83,780).—This company's annual return was filed on March 24th, when 15,619 preference and 6,257 ordinary shares had been taken up out of a nominal capital of £40,000 in 25,000 preference and 15,000 ordinary shares of £5 each. £1 per share has been called up on 9,460 preference and 257 ordinary, and £9,707 has been received. £12,169 is considered as paid on 6,169 preference and 6,000 ordinary shares. Mortgages and charges: £10,000. (A further 2,000 preference and 280 ordinary shares were allotted on April 23rd, the ordinary shares being issued at £3 premium.)

Mather & Platt, Ltd. (60,387).—This company's annual return was filed on April 13th, when 40,000 preference and 40,000 ordinary shares had been taken up out of a nominal capital of £1,000,000 in 50,000 preference and 50,000 ordinary shares of £10 each. £10 per share has been called up on 29,200 preference and 2,500 ordinary shares, and £317,000 has been received. £483,000 is considered as paid on 10,900 preference and 37,500 ordinary shares. Mortgages and charges: Nil.

CITY NOTES.

West India and Panama Telegraph Co., Ltd.

THE sixty-second ordinary general meeting was held on Wednesday, at Winchester House, Old Broad Street, Mr. Walter B. Kingsford presiding.

The CHAIRMAN, in proposing the adoption of the report, said that the total receipts for the half-year had amounted to £37,262, as compared with £34,203 for the corresponding half of last year, an increase of £3,509. The actual traffic receipts had increased by £2,074. In the expenses there had been an increase of £1,416, chiefly attributable to a larger length of cable having been used in repairs and to an increased expenditure at the stations; the latter chiefly under the items of salaries and wages. It was a somewhat remarkable coincidence that in the total expenses of their repairing ship during the half-year there was a difference of only £39 as compared with the corresponding period, notwithstanding the fact that the total, as usually happened in the accounts of a ship, was composed of some 2,000 or 3,000 items of expenditure. Their repairing ship had been thoroughly overhauled and passed her first number one survey, in accordance with Lloyd's requirements. The cost of that, amounting to £892, had been charged against the reserve for depreciation account. During the current half-year they had replenished their stock of cable for repairing purposes by some 250 knots, which had been duly landed at St. Thomas. Doubtless they would expect him to say something about the traffics receipts for the current period as far as it had gone. They would recollect that in the corresponding period of last year they derived additional traffic receipts, owing to the earthquake at Jamaica, and consequently by comparison with that exceptional period the receipts for the current half-year showed a decrease of about £1,900. The favourable results of the accounts with which they were now dealing had enabled the directors to recommend the payment of 26s. per share on account of accrued dividends on the second preference shares. They might be sure it afforded them great pleasure to be able to make that recommendation, as they were naturally anxious to pay off those arrears as quickly as possible.

MR. HENRY HOLMES seconded the motion, and the report was adopted.

Urban Electric Supply Co., Ltd.

THE accounts for the year 1907 show a profit of £35,273. After deducting debenture interest, &c., and £2,074 for depreciation, there remains a balance of £22,512, which falls short by £9,988 of the amount required to meet the 5 per cent. guaranteed dividends on the issued capital. The deficit has been duly provided by Edmundson's Electricity Corporation, Ltd.

The ordinary general meeting of the shareholders of this company was held on Wednesday at Salisbury House, London Wall, Mr. P. D. Tuckett in the chair.

The CHAIRMAN, in proposing the adoption of the report, said that the profit for the year fell short by nearly £10,000 of the sum which was required to pay the 5 per cent. dividend guaranteed on the issued capital of the company; which sum had been duly provided by Edmundson's Electricity Corporation under the contract. That was the parent company, and he (Mr. Tuckett) was now chairman of that as well as of the Urban Co. The parent company held more than half of the ordinary capital of the Urban Co., and in 99 cases out of 100 the interests of the two companies were identical. He was sorry that the progress in the last year had not been as great as they had hoped it would have been, but it was satisfactory to know that there had been some progress. Turning to the accounts, the item of £1,612 for depreciation of stock of wiring goods and fittings represented the accumulation of such stock during the last five or six years. It might have been more satisfactory to have written it off as it occurred, but the board considered it desirable to deal with the amount in a drastic manner. Further sums had been written off in the branch companies on the same account, making a total of £2,220. As far as the shareholders were concerned, it did not matter to them how much was written off, because it was the contractors who had to bear it. The net result was that the contractors were called upon to find £72 less than last year—a result which was not quite so unsatisfactory as it at first appeared when they took into consideration the exceptional item of £2,200 written off for depreciation on fittings, and the fact that coal had cost them more. The expenditure on capital for the year amounted to £38 210, of which they would be glad to know only £4,846 represented free wiring and hire of motors, as against £11,366 for the previous year, and very much larger amounts before that; £3,296 of that amount was on account of Twickenham, and only £1,550 on account of other towns. They were doing all they could to discourage the locking up of capital in that way. While there was no doubt that free wiring had its advantages, it was attended by very serious risks, and he was convinced that it was better to avoid locking up their capital in that way. It was satisfactory to know that in most cases they were now getting more adequate rentals for their wirings than was the case some years ago. The amount due to contractors not at present bearing interest—£190,835—was a very important item. The moment the guarantee expired, at the end of 1910, that advance would bear interest, and in the event of their being unable to pay it off, it could either remain as a loan at interest or else they would have to satisfy it by allotting to the contractors the debentures which were provided for under the contract entered into last year. The auditors in their report had drawn attention to the fact that nothing had been written off preliminary expenses or the discount and expenses on the issue of debenture stock, or the loss on dismantling of free wiring. He admitted that those items were not satisfactory, but he was afraid they must remain as they were during the currency of the guarantee, because while it was running it was not open to the board to deal with them. They could not call upon the guarantors to make them good, and they had no

funds out of which to make them good themselves, and he was afraid that the loss on the dismantling of free wiring would be a recurrent one each year. With regard to the current year, he thought that, on the whole, the prospects were better than last year. They must, however, realise that the industry was passing through what might be considered to be a period of transition between the extravagant hopes of a few years ago, and what he fully believed would ultimately prove to be the solid and permanent prosperity of the years to come. The industry was now a thoroughly well established and progressive one. The advantages of electric light and power were becoming increasingly appreciated, but in the meantime they must accept the anxieties and difficulties necessarily incident to a transition period, and if it should turn out that they were not able to increase the profits as much as they would like, he could assure them that it would not be through any want of effort on their part. That the metallic-filament lamp would enable them to show steady progress in the matter of lamp connections, he thought was certain. Lamp connections, however, were not the sole criterion of satisfactory progress, and whether in the first instance they would produce a return over and above the interest on the new capital, sufficient to more than make good the possible loss in the substitution of the metallic-filament lamps for the old carbon lamps, remained to be seen. Fortunately they were not unfavourably situated in this respect, since in every case they were supplying at a voltage exceeding 200 volts and in direct current, and, therefore, it was very difficult for metallic-filament lamps to be adopted to their serious prejudice. All their heavy capital expenditure was now completed, and all new capital would be spent with the greatest care, and only with the assurance that it would bring in an adequate return. He did not mean to say that there would be a diminished return on their old capital—if there was they would be extremely disappointed, but at the same time there was an uncertain element to be reckoned with. Everything he feared pointed to a period of trade depression, the effects of which they could not hope altogether to escape. Without taking a gloomy view of the future personally, he did not anticipate that the progress of the next few years could be otherwise than slow, but he saw no reason to doubt that it would be steady, and that the company's position would be very much improved by 1911, when the guarantee expired. There was no question as to the ability of Edmundson's to meet their guarantee. Till that time their dividends were assured. He was not going to prophesy as to the future, but he would give them a rough approximation of what the general position would, in his opinion, be in 1911 if certain assumptions were realised. The whole thing was merely an estimate, and although he did not think it was an extravagant one, it might, or might not, be realised. Assuming that the gross profits increased by £4,000 a year, or by £16,000 in all during the four years, and that the head office expenses were £2,500, and taking the additional capital charges, including interest, at £17,500, the balance available in 1911 for depreciation and payment of preference dividend would be approximately £22,000. The preference dividend required £12,500, leaving £9,500 available for depreciation. Of course it was quite possible, and, indeed, he was full of hope, that the results might be somewhat better than that forecast. As to the ordinary shareholders, having regard to the inadequacy of the depreciation provision to which the auditors had called attention, and to the fact that Edmundson's advance would be bearing interest in 1911, he saw no prospect of their being able to declare any ordinary dividend that year, and it was idle to speculate on the prospect of future years. The business was an absolutely sound and progressive one, based on concessions of great value, and although the results had so far been disappointing, he felt confident that the position would steadily, if slowly, improve, and that it was only a question of time for them to see dividends earned on the ordinary capital.

Mr. F. E. Gripper seconded the motion, which was adopted.

Madras Electric Supply Corporation, Ltd.

The directors' report for 1907 (December 31st) states that when the construction contract is completed the accounts will be re-arranged in the form required by the Government of India, showing the items of capital expenditure under the several headings as prescribed in the model form. The construction of the generating station is not so far advanced as the board expected, owing to delays in obtaining bricks and other materials. The plant, machinery and appliances are ready for installing. The mains in the compulsory area have been laid as required by the terms of the licence, with the exception of a small length, the materials for which were diverted to extensions required for the supply of some intending consumers. The contracts for the tramway generating plant, the feeders and the erection and equipment of the sub-station, necessary for the supply to the tramways, have all been let, and it is hoped that the commencement of tramway supply will be made at the beginning of next year. There are a number of consumers already connected with the mains, with an equivalent of 3,656 lamps of 8 c.p. These are being supplied from the small temporary plant, and it is not considered advisable to make further connections until the permanent machinery is at work. Applications have been made to the Government for extensions of the licence to enable the company to supply current in Fort St. George, and to the Port Trust in Madras. The directors have appointed Messrs. Fraser & Ross, chartered accountants in Madras, auditors, for the purpose of examining and certifying the accounts of the company in that City.

West African Telegraph Co., Ltd.

The twenty-third ordinary general meeting of this company was held on May 28th at Electra House, Finsbury Pavement, the Marquis of Tweeddale in the chair.

In proposing the adoption of the report (see Electrical Review, May 22nd, page 879), the Chairman said that the gross revenue for the year had amounted to £59,206, against £66,158 for the year 1906, or a decrease of £6,952. Their proportion of the receipts from the South African joint purse continued to decline, and was in 1907 £3,588 less than in the preceding year. There had also been a considerable falling off, amounting to £2,509, in the receipts from the Portuguese traffic, and a further diminution as compared with 1906 in the same route on account of the diversion of traffic from their lines, owing to interruptions to cables of other telegraph companies. The gross revenue had also been adversely affected during the past year in consequence of the rate of exchange not being so favourable, the reduction under this head amounting to £1,200. As a set off against those reductions, the interest on the reserve fund investments showed an increase of £853. As regarded the expenditure, the items showed little variation. The total expenses were about £1,000 more, £300 of that being in respect of working expenses at stations due to special repairs at one of their buildings, while expenses attending the maintenance of cables were about £650 more. Last year he referred to the fact that it had been decided to renew a portion of the St. Thomé-Loanda section of their cables. That work had been carried out during the year, and about 106½ knots of new cable had been used in the operation. The total cost of that renewal had not yet been ascertained, but the general reserve fund had been debited with £8,624 14s. 7d., representing part of the cost. The balance would be charged to the current year, and would be a comparatively small amount. After making a contribution of £24,000 to the general reserve fund, and allowing for the interim dividend of 2 per cent. paid in December, the directors were able to recommend the payment of a final dividend of 2 per cent., making 4 per cent. for the year, leaving £831 to be carried forward to the next account. Their managing director, Sir John Denison Pender, was attending the conference in Lisbon, looking after the interests of the company as well as those of the other Associated Companies.

Sir Henry Mance seconded the motion, and the report was adopted.

Bruce Peebles & Co., Ltd. (In Liquidation).

Our Edinburgh correspondent writes:—"The statement is made that a scheme of reconstruction has been prepared dealing with the affairs of Messrs. Bruce Peebles & Co., Ltd., electrical engineers, East Pilton, Edinburgh. This scheme is understood to have received the approval of committees of creditors and shareholders, and will be presented to the Court for sanction in the course of the week. Under this scheme, the holders of the £75,000 of debentures of the company will rank first. Then the unsecured creditors will receive 7s. 6d. in the £ in new debentures (ranking after the old debentures) and 12s. 6d. in the £ in fully paid-up shares of the new company to be formed. The present preference shareholders are to be asked to take three new shares of £1 each for every £5 they held in the old company, and to pay 10s. per share in cash, they receiving the £1 shares fully paid up. The ordinary shareholders are to be asked to take a new share of £1 for every £5 held in the company on condition that they pay 10s. per share in cash, the £1 share being then issued to them as fully paid up. Thus the capital of the new company will be £250,000 in £1 shares. The 10s. per share which the preference and ordinary shareholders will pay will yield a sum of between £40,000 and £50,000, which will form the working capital of the new company. The new board of directors, comprising six or seven members, will represent the creditors, shareholders, and debenture-holders. The names suggested as directors, embrace Ex-Bailie Mackenzie, Edinburgh; Mr. John Cowan, Edinburgh; Mr. C. J. Shiells, C.A., Edinburgh; Mr. Tait, the liquidator; and Mr. Mountain, of Messrs. Mountain & Gibson."

Prospectus.—*Marconi's Wireless Telegraph Co., Ltd.*—This company has this week been offering for subscription at par 250,000 7 per cent. cumulative participating preference shares of £1 each. The issue was referred to in the recent report of the directors, and was commented upon by us in the Electrical Review of May 1st, 1908. The list was to close yesterday for the Continent.

Aluminium Corporation, Ltd.—Mr. R. S. Portheim presided on Monday at an extraordinary meeting of this Corporation, held at Winchester House, E.C. Approval was given to a proposal to apply to the Light Railway Commissioners for an Order to construct the Abbey, Dolgarrog and Trefiw Light Railways. The chairman said that the length of the line was only about ¾ mile, and the cost would be £10,000. It would give the company greater facilities for communication between their power station and the L. & N.W. Railway.

France.—The report of the Société d'Energie Electrique du Littoral Mediterranean for the last financial year shows a profit of £47,582, as compared with only £42,454 in the preceding 12 months.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
†Aberdeen	May 20	1,390	+ 84	51	68,743	— 1,231	14·4	..
Ayr	,, 30	561	— 89	..	..	..	8	..
Bath	,, 30	1,660	— 206	21	13,460	— 1,499	18	..
Belfast	,, 29	7,435	— 178	9	31,861	+ 359	37	..
Birkenhead	,, 31	2,140	+ 89	9	9,235	+ 370	13·52	..
Birmingham Corp.	,, 23	12,809	— 349	8	48,522	+ 1,189	56·46	..
Blackburn	,, 28	1,153	—2,337	9	6,052	— 126	21·5	..
Blackpool Corp.	,, 14	1,080	+ 87	..	4,899	+ 813	11·67	..
,, —Fleetw'd.	,, 30	737	—1,485	21	6,881	— 1,723	8·25	..
Bolton	,, 31	4,771	— 581	9	20,935	+ 671	26	..
Bournemouth	,, 27	2,946	— 703	8	13,211	— 1,206	21·5	..
Bradford	,, 23	9,557	+ 776	8	35,701	+ 1,496	54·9	1
Brighton	,, 31	1,710	— 323	9	7,155	— 350	9·5	..
Bristol	,, 29	9,253	—1,634	..	..	..	12·21	..
Brit. Elec. Trac. Co.								
Airdrie	,, 22	452	— 12	20	4,485	+ 49	3·65	..
Barnsley	,, 22	361	— 21	,,	3,440	+ 183	..	..
Barrow	,, 22	484	— 118	,,	4,486	— 80	5·37	..
Cavehill	,, 22	198	+ 5	,,	1,560	+ 93	..	..
Devonport	,, 22	885	— 83	,,	8,733	— 188	3·85	..
Gateshead	,, 22	1,949	— 153	,,	19,914	+ 120	11·25	..
Gravesend	,, 22	415	+ 156	,,	3,883	— 702	6·5	..
Greenock	,, 22	1,068	— 357	,,	9,870	— 2,765	7·25	..
Hartlepool	,, 22	435	— 211	,,	4,260	..	6·72	..
Kidderminster	,, 22	197	— 131	,,	1,802	— 279	..	..
Leamington	,, 22	294	— 108	,,	2,811	— 65	8	..
Merthyr	,, 22	407	— 89	,,	4,099	— 50	2·9	..
Metropolitan	,, 22	12,188	+1,533	,,	102,319	+18,218	23	..
Middleton	,, 22	749	— 51	,,	6,621	+ 27	8·5	..
Mid. Joint Com'tee	,, 23	11,638	—2,068	,,	111,726	— 2,716	..	..
Oldham—Ashton	,, 22	1,209	— 86	,,	11,751	— 82	9·13	..
Peterborough	,, 22	252	— 45	,,	2,221	— 86	5·31	..
Potteries	,, 23	3 576	+ 506	,,	36,731	— 7	29	..
Rothesay	,, 22	305	— 37	,,	1,729	— 157	2·75	..
Southport	,, 23	536	— 241	,,	4,495	— 589	3·17	..
S. Metropolitan	,, 22	1,689	— 62	,,	14,115	— 337	..	..
Swansea	,, 22	1,751	— 207	,,	17,470	+ 975	5·5	..
Tynemouth	,, 22	378	— 166	,,	3,087	— 497	3·75	..
Weston-s-Mare	,, 20	165	— 222	,,	894	— 325	3	..
‡Worcester	,, 22	544	— 108	,,	4,974	+ 160	5·75	..
Wrexham	,, 22	199	— 23	,,	1,935	+ 25	..	..
Yorks. Wool. Dist.	,, 22	1,850	— 315	,,	17,881	— 1,006	17	..
Miscellaneous	,, 22	408	— 112	,,	3,769	— 402	..	..
Burnley	,, 30	2,523	— 62	..	..	..	7·5	..
Burton-on-Trent	,, 31	521	— 85	9	2,296	— 208	6·5	2
Bury	,, 21	2,360	— 152	7⅔	9,280	+ 977	10·5	..
Cardiff	,, 23	4,185	+ 543	8	15,988	— 480	..	..
Carlisle	,, 30	343	— 29	22	3,426	— 6	..	..
Chatham and Dist.	,, 28	1,649	+ 107	21	14,297	— 84	14·37	1·53
Cork	,, 28	1,017	+ 3	21	8,838	— 459	9·89	..
Croydon	,, 29	3,097	+ 29	9	11,942	— 620	12	·75
†Darlington	,, 23	191	— 86	8	1,560	— 125	..	..
Darwen	,, 29	510	— 13	8	2,186	— 78	4·36	..
†Dover	,, 28	188	— 92	8	1,482	— 326	4·75	..
Dublin	,, 29	11,024	—1,670	..	105,287	— 1,900	54·25	5·5
Dundee	,, 27	2,417	+ 183	..	..	..	14·5	..
East Ham	,, 30	1,742	— 214	9	7,244	— 628	7·75	..
Glasgow	,, 30	36,507	+ 188	49½	905,212	+14,230	89·25	1
Hastings	,, 28	1,921	— 488	..	..	..	..	..
†Huddersfield	,, 23	1,691	— 288	8	12,696	— 294	28·5	·5
Hull	,, 30	4,750	— 166	9	20,860	— 280	13	..
Ilkeston	,, 27	299	— 8	8	1,259	— 16	3·5	..
Ipswich	,, 30	763	— 87	9	3,104	— 259	10·5	..
†Kilmarnock	,, 28	161	— 6	52	8,066	— 163	4·25	..
Lan'kshire Trm. Co.	,, 30	2,689	+ 247	21	26,838	+ 3,293	21	3·26
Lancashire United	,, 27	2,827	— 484	21	26,196	+ 716	89	1
Leeds	,, 28	18,123	— 724	8	48,904	+ 96	96	6·5
Leicester	,, 30	4,614	— 230	..	..	..	..	..
†Leith	,, 23	526	+ 20	52	26,708	+ 329	6	..
Liverpool	,, 28	21,764	— 695	21	216,119	— 2,699	104	..
†L.C.C.	,, 16	67,576	+3,716	6½	214,626	+17,478	119·5	6
London United	,, 30	15,658	+ 20	..	124,811	— 2,667	..	..
Lowestoft	,, 20	343	— 89	35	5,487	+ 97	3·5	..
Manchester	,, 30	31,036	—1,382	9	129,188	+ 3,766	86	11
Newcastle	,, 30	7,326	— 786	9	32,605	— 3,658	..	..
Newport	,, 30	1,290	— 216	9	5,784	— 213	14·5	..
†Northampton	,, 29	459	+ 45	8⅔	3,694	— 142	5·5	..
Oldham	,, 31	4 062	+ 189	9	19,331	— 12	28·75	..
Pontypridd	,, 30	664	+ 47	9	3,122	+ 647	5	1·75
Portsmouth	,, 30	3,818	— 360	9	15,900	— 1,048	14·5	..
Preston	,, 27	1,429	— 281	..	..	..	..	..
Reading	,, 28	1,220	— 71	8⅔	4,972	— 156	13·25	..
Rotherham	,, 28	1,231	— 81	8⅔	5,014	— 89	10	·66
Salford	,, 25	9,275	—1,546	8	36,306	— 2,186	38·9	..
†Sheffield	,, 24	5,694	— 267	8⅓	47,593	— 1,758	36·25	·5
Southampton	,, 27	2,036	— 86	8	8,192	+ 237	..	..
Southend-on-Sea	,, 27	733	— 101	9	2,849	— 74	..	..
Sunderland	,, 31	2,807	— 542	9	9,834	— 2,414	..	..
†Swindon	,, 27	150	— 15	..	..	..	4·4	..
Tyneside	,, 27	767	— 127	22	7,735	— 1,208	3·87	..
Wallasey	,, 30	1,787	— 86	8½	7,345	+ 79	3·72	·22
Walthamstow	,, 30	1,414	+ 24	9	5,486	+ 330	9	..
West Ham	,, 28	4,462	— 409	9	19,469	— 2,051	14·7	..
Wolverhampton	,, 27	1,608	— 551	8	6,796	— 558	13·5	..
Baker St.-Waterloo	,, 30	5,715	+ 720	22	67,395	+15,329	4·25	1
Cen. London Rly.	,, 30	13,596	+2,342	22	133,888	— 657	5·77	..
Char. +, Eus. Hamp.	,, 30	6.685	..	22	70,580	..	7·75	..
City & S. Lon. Rly.	,, 31	5,627	— 430	22	71,179	+ 6,125	7·3	1·05
Dublin-Lucan Rly.	,, 29	262	— 20	22	2,299	+ 60	7	..
G.N. and City Rly.	,, 30	3,102	— 261	22	27,743	— 2,464	3·5	..
G.N., P'dy. & Brmtn.	,, 30	10,760	+2,220	22	119,220	+34,001	9·25	·25
L'pool Overh'd Rly.	,, 31	2,927	— 307	22	30,688	— 776	6·8	4·8
Mersey Railway	,, 30	3.687	— 90	22	42,050	+ 1,584	4·5	..
Metropolitan Rly.	,, 31	31,186	— 384	22	336,201	+ 2,554	24·5	..
Met. District Rly.	,, 30	18,188	+1,770	22	195,727	+21,285	24	..
Anglo-Argentine	,, 27	87,991	+3,810	21⅔	390,326	+43,078	42	..
§Auckland	Apr. 24	11,783	+ 801	16⅔	48,883	+ 5,749	19·2	·56
§Brisbane	May	15,548	+2,273	..	..	..	..	..
Buenos A. & Belgr'o.	,, 27	7.899	+ 115	21⅓	80,107	+ 671	..	..
Calcutta	,, 30	5,716	— 207	..	..	..	..	..
§Geneva	April	7 609	+ 553	..	..	..	..	..
§Kalgoorlie, W.A.	,,	3,721	..	16	15,040	..	20·5	..
Madras	May 31	1,209	+ 69	22	12,759	+ 1,354	12·75	..
Perth (W.A.)	,, 29	2,820	+ 181	22	29,078	— 852	25·6	25·6

* Compared with the corresponding period of 1907. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

By the reduction in the Bank Rate to 2½ per cent. last Thursday, as reported in our previous issue, a considerable amount of new money has been diverted to Stock Exchange markets. Investment appears to have awakened to the fact that although money is a drug as regards the interest allowed on deposit accounts, securities even of the highest grade are still standing at reasonable levels of prices, and a good demand for sound stocks is one of the features of the moment.

New issues have started again to swamp existing stocks and shares. Amongst the latest comers is the Marconi Wireless Telegraph Company's offer of a quarter of a million 7 per cent. cumulative participating preference shares of £1 each. The Ordinary shares, which were standing at about 8s. 6d., have risen 2s. 6d.—some people suggest it is by way of preparing a favourable reception for the new Preference, than which there are many more attractive investments.

How capital is coming into the markets can be seen by glancing at the quiet advance which has taken place amongst debenture stocks. The telegraph list shows several of such rises, which are small in extent, but none the less significant. A forward movement in Consols and gilt-edged stocks is frequently the prelude to improvement in other markets.

Besides the prior-charge issues, Telegraph and Telephone descriptions are mostly good. The Anglo-American Telegraph trio exhibits substantial rises, and speculation already discusses the probable showing to be made by the next half-yearly statement. The Deferred stock was shot up to 17. Other trans-Atlantic cable varieties are ignored.

Both Indo-Europeans and Great Northerns present exceptions to the general firmness of prices in this list. Eastern stocks and shares are steady. West India and Panama are again higher, and Western Telegraphs improved. Reuter's are *ex* 4s. dividend.

American Telephone and Telegraph capital stock has advanced, and the 4 per cent. Bonds gained 3. National Telephone Deferred and 3½ per cent. Debenture stocks are ½ up, and United River Plate Telephone shares are better. In fact, telephone issues are mostly higher on the week.

The increased dividend on Globe Telegraph and Trust Ordinary has led to another rise in both classes of shares.

Metropolitan omnibus and railway companies whose routes run anywhere near Shepherd's Bush are much in vogue. The glamour and the effect of the Franco-British Exhibition have, to some extent, worn off so far as the railway market is concerned, but the stocks remain hard, and Districts put on 30s. this week. Central London Ordinary and Deferred have both risen, and a point gain is secured by City and South London Ordinary stock. Metropolitan Railway stock has been erratic in its movements; on balance showing very little change. The Surplus Lands stock gained a point.

While there is a good deal of activity in omnibus stocks and shares, the name of Electrobus has been hardly mentioned.

British Electric Traction Debenture stocks are better, but the Ordinary shares have weakened. Anglo-Argentine Tramways Second Preference, with a rise of 6s. 3d., came into demand upon the cheapening of money.

Electricity Supply shares are amongst the few that have so far failed to appreciate by reason of easier money. There is a general slackness about the market, and prices have given way in several cases. This dull tendency communicated itself to some of the manufacturing shares, but the movements are without importance.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

British Columbia Electric Railway Co., Ltd.—Further issue of £100,000 preferred ordinary stock.

And to allow the following securities to be quoted in the Official List:—

Mexican Tramways Co.—$6,000,000 additional general consolidated first mortgage 50-year 5 per cent. gold bonds.

Montreal Street Railway Co.—£460,000 4½ per cent. sterling debentures, in lieu of the scrip now quoted.

Sao Paulo Tramway, Light and Power Co.—It is reported that the gross earnings of this company for 1907 were $2,111,523, as compared with $2,018,703 for 1906, and the net earnings $1,395,873, as compared with $1,368,162. Three quarterly dividends of 2 per cent. each, and one of 2½ per cent., were paid. $100,000 was placed to the credit of contingent account, and $244,974 to credit of profit and loss.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations May 26th.	Closing Quotations June 2nd.	Business done week ended June 2nd, 1908. Highest.	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2 — 3	2 — 3	..	..	..	Nil
143,300	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	5 %	5 %	5 %	84 — 87	84 — 87	..	..	..	5 14 11
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7¼%	7⅞%	8 %	8 %	118 —122	118 —122	..	..	..	6 11 2
53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	83 — 86	87 — 90	..	..	+ 4	4 8 11
598,180	Anglo-American Telegraph	Stock	3⅜%	3½%	3½%	3½%	58 — 61	59 — 62	60½	..	+1	5 12 11
3,200,910	Do. do. do. 6 % Pref.	Stock	5⅝%	6 %	6 %	6 %	102 —104	104 —106	105	103	+2	5 13 3
3,200,910	Do. do. do. Deferred	Stock	Nil	⅛	1⅜%	1 %	16 — 16½	17⅛ — 17⅝	17 7/16	16 1/16	+1⅛	5 19 5
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	5 %	5 %	5 %	98½—101½	99 —102	..	..	+ ½	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	7 — 7½	7 — 7½	..	..	..	5 6 8
2,383,376	Commercial Cable Sting. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	84 — 87	84 — 87	..	..	..	4 12 0
16,000	Cuba Telegraph	10	5 %	5 %	5 %	..	7½ — 8½	7½ — 8½	..	..	..	6 1 3
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	15½ — 16½	15½ — 16½	..	..	..	5 19 5
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3¾ — 3⅞	3¾ — 3⅞	..	..	..	5 14 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 9	8 — 9	..	..	..	5 11 1
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99½—102¼	100—103	..	..	+ ½	8 14 10
60,710‡	Direct United States Cable	20	3½%	4½%	4½%	..	13½— 14	13¾— 14	13⅞	13½	..	6 12 2
53,700‡	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99½—101½	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	129 —134	130 —135	133	131½	+1	5 3 8
2,000,000	Do. 8½ % Pref. Stock..	100	8½%	8½%	8½%	8½%	83 — 86	83½ — 86½	85½	84	+ ½	4 0 11
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	100 —102	100⅛—102⅛	101⅛	100⅞	+ ⅛	3 18 1
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	12⅞ — 13½	12⅞ — 13½	13	12⅞	..	5 5 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	100 —102	100⅛—102⅛	101⅛	..	+ ⅛	3 18 1
269,700	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	4 %	99½—100½	100 —102	..	..	+ ½	3 18 5
200,000‡	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	15 17 0
181,127	Globe Telegraph and Trust	10	5⅜%	5½%	5½%	5⅝%	10 — 10½	10⅛— 10⅜	10 7/16	10⅛	+ ⅛	5 10 9
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13½ — 14	13⅝ — 14⅛	13 15/16	13 13/16	+ ⅛	4 4 11
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24 %	24%	20 %	20 %	28 — 30	27 — 29	30	28½	—1	6 17 11
24,300‡	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	53 — 56	52 — 55	53	52	—1	6 16 4
$41,380,400	Mackay Companies Common	$100	1 %	2 %	3½%	4 %	58 — 63	58 — 63	..	..	..	6 7 0
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	62 — 66	62 — 66	..	..	..	6 1 3
384,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅜ — ½	⅜ — ½	12/9	10/6	+ ⅛	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	4 %	5 %	6 %	6 %	1 3/32 — 1 5/32	1 3/32 — 1 5/32	19/4½	..	..	4 14 1
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	15/16 — 1	15/16 — 1	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	108 —110	108 —110	109½	108½	..	5 9 1
3,725,000	Do. do. Def. Stock	100	5 %	5 %	5 %	6 %	109½—111½	110 —112	111½	110⅝	+ ⅛	5 7 2
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10⅝— 12⅝	10⅝— 12⅝	..	..	..	4 16 0
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	5 %	5 %	10⅝— 12⅝	10⅝— 12⅝	..	..	..	4 0 0
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅜— 5⅝	5⅛	5⅜	..	4 8 11
2,000,000	Do. do. 8½ % Deb. Stock Red. ..	Stock	8½%	8½%	8½%	8½%	98½—100⅝	99 —101	99⅛	99	+ ⅛	8 9 4
1,716,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	101½—103⅛	101½—103⅛	..	..	..	3 17 4
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	6¼%	7 %	7 %	8 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	5 17 5
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1⅛ — 1¼	1⅛ — 1¼	22/9	..	..	4 16 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	..	4 %	4 %	4 %	90 — 93	90 — 93	91½	..	..	4 6 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	98 —101	98⅜ —101½	..	..	+ ⅛	3 18 10
11,839‡	Reuter's	8	5 %	5 %	5 %	5 %	7⅞ — 8½	7⅞ — 8½	..	..	..	4 14 1
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
3,083	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	127 —130	127 —130	128½	..	..	4 12 4
100,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅛— 6⅞	6⅛— 6⅞	..	..	+ ⅛	5 16 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	4⅝— 5⅛	5 — 5½	..	..	+ ⅛	4 15 3
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2	Nil	Nil	2½%	..	1⅜— 1⅝	1⅜— 1⅝	..	..	..	3 1 6
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	..	13½— 13⅝	13⅝— 13⅞	13 15/16	13½	+ ⅛	5 0 11
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100 —102	100⅛—102⅛	..	..	+ ⅛	3 18 1
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅜ — ½	⅜ — ½	..	..	+ 1/32	Nil
34,568	Do. do. 6 % Cum. 1st Pref.	10	6 %	5 %	8 %	6 %	8⅝ — 8¾	8½ — 9	8 13/16	8⅝	+ ⅛	6 13 4
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	£2 6 0	9 — 10	9½ — 10½	9⅝	..	+ ½	2 4 9
80,000‡	D do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —104	101 —104	..	..	..	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	8 %	8 %	8 %	9 %	7⅞— 8⅛	8 5/16— 8 7/16	8 7/16	7 15/16	+ 5/16	5 0 8
260,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5⅛%	5⅛%	5⅛%	5 2/16%	6¼— 6½	6½— 6⅝	6 9/16	6 7/16	..	4 8 6
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	140 —145	140 —145	..	..	..	5 14 3
225,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 —107	104 —107	105½	..	..	4 13 6
880,000	Babcock & Wilcox, 1 to 880,000..	1	20 %	20 %	20 %	20 %	8⅝— 8¾	8⅝— 8¾	75/7½	73/9	..	5 6 8
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 5/16— 1 7/16	1 5/16— 1 3/8	..	..	..	8 16 10
40,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	3½— 3⅝	3½— 3⅝	66/6	63/0	..	9 13 1
40,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	4 — 4⅛	4 — 4⅛	82/6	80/-	..	7 15 7
20,000	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	4⅜— 5⅛	4⅜— 5⅛	..	..	..	5 14 3
20,000	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3⅞— 4⅛	3⅞— 4⅛	..	..	..	4 14 1
288,200	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	102 —106	104 —108	..	..	+2	4 12 7
800,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	5½%	5½%	97 —100	97 —100	..	..	..	5 18 6
400,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	6 %	6 %	8 %	132 —135	128 —132	132½	..	—3½	6 1 3
800,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	115 —119	112 —115	117	..	—3½	4 6 11
800,000	Do. 5 % Cum. Perp. Pref. Stock ..	100	5 %	5 %	5 %	5 %	108 —112	107 —111	..	..	—1	4 10 1
285,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250 ..	40	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 2
133,301	British Electric Traction	10	6 %	3 %	Nil	Nil	1½— 1⅝	1½— 1⅝	..	..	— ⅛	Nil
161,497	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	3⅜— 4⅛	3⅜— 4⅛	80/-	75/-	..	14 10 10
1,473,553	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	88 — 92	90 — 95	93	..	+2½	5 5 3
528,336	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	69 — 73	71 — 75	..	..	+2	6 0 0
100,000	British Insulated and Helsby Cables	5	8 %	8 %	10 %	..	6⅞— 6⅞	5⅞— 6⅛	6	..	— ⅛	8 0 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅞— 6⅛	5⅞— 6⅛	..	..	+ ⅛	4 16 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
312,000	British Thomson-Houston 4½ % 1st Mort. Debs.	100	4½%	4½%	4½%	4½%	98 — 98	98 — 98	..	..	..	4 11 10
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	7/16— 11/16	7/16— 11/16	..	..	..	Nil
1,016,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	45 — 50	45 — 50	..	..	..	8 0
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16— 11/16	9/16— 11/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	2½%	Nil	Nil	0 — ½	0— ½	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	Nil	Nil	5/16— 7/16	5/16— 7/16	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock.	Stock	4½%	4½%	4½%	4½%	70 — 75	70 — 75	..	..	..	6 0 0
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	55 — 60	55 — 60	..	..	..	7 10 0
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	4 %	3 %	3 %	..	4⅛— 4⅞	4⅛— 4⅞	96/6	95/-	+ 1/16	3 1 6
40,000	Do. do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	6 %	4⅝— 5⅛	4⅝— 5⅛	..	..	..	5 17 1
27,500	Do. do. "B" do., 1 to 27,500	5	6 %	6 %	6 %	6 %	4⅝— 5⅛	4⅝— 5⅛	..	..	..	5 17 1
136,400	Do. do. 5 % Deb. Stock	100	5 %	5 %	5 %	5 %	110 —116	110 —116	..	..	..	4 6 2
190,000	Do. do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 3
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	8 %	6 %	5⅞— 6⅛	5⅞— 6⅛	6⅛	5¼	— ⅛	4 14 1
30,000	Do. 5 % Cum. Pref., Nos. 1 to 29,980..	5	..	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 18 0
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
86,000	Callender's Cable Construction shares	5	12½%	15 %	15 %	15 %	10 — 11	9⅞— 10⅞	..	..	— ⅛	6 19 6
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛— 5⅜	5⅛— 5⅜	..	..	..	4 5 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	106⅛—108½	107 —109	..	..	+ ⅛	4 2 7
491,222	Cape E Trams., 1 to 491,222	1	5 %	Nil	Nil	Nil	1/16— 3/16	1/16— 3/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	6 %	8 %	..	1 5/16— 1 7/16	1⅛ — 1⅜	26/9	..	— 1/16	5 11 4
215,045	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
1,893,610	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	3 %	79 — 82	81 — 84	83⅛	80½	+2	3 11 5
553,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	90 — 92	90 — 92	92	91	..	4 7 0
553,195	Do. do. Def. do.	Stock	4 %	4 %	4 %	2 %	62 — 65	64 — 67	67	63½	+2	2 19 8
1,480,000	City and South London Railway	Stock	2½%	1⅞%	2½%	2½%	39 — 41	40 — 42	41⅞	40⅞	+1	5 1 0

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations May 26th.	Closing Quotations June 2nd.	Business done week ended June 2nd, 1908. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d
85,000	Crompton & Co., Nos. 1 to 85,000	* 8	2½%	2½%	5 %	5 %	1⅛ — 1⅜	1⅛ — 1¼	..	..	..	8 13 11
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	92 — 95	92 — 95	..	..	..	5 5 11
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	7 12 5
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	4 16 0
282,580	Do. dc. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100—103	101 —104	..	..	+1	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6 %	6%	6 %	6¾%	12⅛ — 13⅛	12⅛ — 13⅛	..	..	..	4 18 2
59,987	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	12⅝ — 13⅜	12⅝ — 13⅜	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	2½%	4½%	4½%	4½%	3/8 — ½	3/8 — ½	..	..	..	16 15 0
17,139	Do. "A" shares, 01—017,139	5	2½%	4½%	4½%	4½%	1⅝ — 2⅛	1⅝ — 2⅛	..	..	..	b b 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	78 — 81	78 — 81	..	..	..	4 18 9
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	85 — 87	85 — 87	..	..	..	5 14 11
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	3/8 — ½	¼ — ⅜	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	Nil	Nil	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	Nil
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	6 1 3
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	87 — 90	87 — 90	..	..	..	4 8 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	4 %	¾%	½ — 1⅛	½ — 1⅛	..	..	..	3 6 8
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼ — 10⅜	10¼ — 10⅜	..	..	..	6 10 5
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 —103	102 —103	..	..	..	4 17 1
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15%	15 %	15%	10⅜ — 11⅛	10⅜ — 11⅛	..	..	..	8 18 10
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	4⅛ — 5⅛	5 — 5⅛	5⅛	5	+ ⅛	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	104 —106 xd	..	..	—2	4 4 11
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	5 %	10%	10 %	..	15⅛ — 16⅛	15⅛ — 16⅛	15⅝	..	..	6 1 3
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	Nil	Nil	¾%	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5½ — 6⅛	5½ — 6⅛	..	..	..	8 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	6 %	3 %	3 %	..	6⅛ — 6⅜	6⅛ — 6⅜	..	..	..	4 8 11
399,930	Do. do. 60,008 to 100,000	10	6 %	3 %	3 %	..	6⅛ — 6⅜	6⅛ — 6⅜	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	7 — 8	7 — 8	7⅜	7⅛	..	6 5 0
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	80 — 85	80 — 85	80⅜	..	..	4 14 2
5,782,062	Metropolitan Consolidated	100	3 %	2⅜%	1 %	¾%	43⅜ — 44⅛	43⅜ — 44⅛	44⅛	43⅜	..	1 2 5
2,640,914	Do. Surplus Lands	100	2⅜%	2⅝%	2⅜%	2⅜%	66 — 68	67 — 69	68⅛	..	+1	3 19 9
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	12⅛ — 13⅛	14 — 15	15	13	+1½	Nil
314,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	..	3/32 — 5/32	3/32 — 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/16 — 1/8	1/16 — 1/8	..	..	..	6 3 1
350,000	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	94 — 97	94 — 97	95	..	..	4 12 9
245,500	Potteries E. Trc.	1	5 %	4 %	4 %	4 %	¼ — ⅜	¼ — ⅜	..	..	..	8 0 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅜ — ½	⅜ — ½	..	..	..	6 13 4
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	91 — 94	91 — 94	93½	..	..	4 18 9
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	17½%	29 — 31	29 — 31	30½	29½	+ ½	7 0 0
150,000‡	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —103	101 —103	..	..	..	8 17 8
3,599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	5 %	5 %	5 %	5 %	39 — 43	39 — 43	..	..	..	11 12 6
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	Nil	Nil	10 %	2⅜ — 1½	2⅜ — 1½	20/7½	..	..	8 0 0
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	Nil	Nil	..	6 %	8⅜ — 8¾	8⅜ — 8¾	..	..	..	7 10 0
46,404	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	72 — 76	70 — 74 xd	..	..	..	5 5 3

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P,. 1 to 15,000	5	5½%	5½%	5½%	5½%	4⅛ — 5	4⅛ — 5	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 10 11
30,131	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10%	10 %	6⅞ — 7⅜	6⅞ — 7⅛	6⅞	..	— ⅛	6 13 4
9,869	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6⅞ — 7⅜	6⅞ — 7⅛	..	..	..	4 10 4
386,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 — 102	97 —100	..	..	—2	4 0 0
80,000	Charing Cross and Strand Electricity Supply	5	8 %	5 %	5 %	5 %	3⅜ — 3⅝	3⅛ — 3⅜	70/-	..	..	6 13 4
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛ — 4⅜	4⅛ — 4⅜	91/3	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	5 5 11
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 0 10
49,496	Chelsea Electricity Supply, Ord.	5	6 %	6 %	4½%	4½%	3⅝ — 3⅞	3 — 3⅛	62/6	..	— ⅛	6 8 7
175,000‡	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	9½ — 10½	9 — 10	9⅝	9 9/16	— ½	6 0 0
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 13	12 — 13	12 1/16	..	..	4 12 4
400,000‡	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	124 —127	124 —127	..	..	..	3 18 9
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	102 —105	102 —105	104½	..	..	4 5 9
40,000	County of Durham Electrical Power, Ord.	5	£8 7 0	4 %	4 %	2 %	2⅜ — 3	2⅜ — 3	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	5 17 8
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4½%	5 %	5 %	5 %	7⅜ — 8⅛	7⅜ — 8⅛	7 1/16	..	— ⅛	6 1 3
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜ — 11	10⅜ — 10⅝	10⅝	..	— ⅛	5 10 4
400,000‡	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	107 —110	107 —110	..	..	..	4 1 10
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	96 — 99	97 —100	99⅛	98	+1	4 10 0
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	4 %	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	11 0 0
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	3 %	Nil	¾ — 1	¾ — 1	16/6	..	..	12 0 1
433,000	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	65 — 75	65 — 75	67	..	..	6 0 0
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 4 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 11
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 12 9
15,000	Hove, 1 to 15,000	5	8½%	9 %	9 %	8½%	6⅛ — 6⅜	6 — 6⅛	..	..	— ⅛	6 10 9
21,000	Kensington and Knightsbridge Electric Ord.	5	12 %	10 %	10 %	10 %	7 — 8	7 — 8	..	..	..	6 5 0
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 0 10
10,000	London Electric Supply Corporation, Limited, Ord.	3	3 %	4 %	4 %	2½%	1 — 1⅛	⅞ — 1⅛	20/7½	..	— ⅛	5 8 1
70,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅜ — 4⅝	4⅛ — 4⅜	..	..	— ⅛	6 6 4
74,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4½%	90 — 93	90 — 93	..	..	..	4 16 9
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	10 %	8 %	6½%	4⅜ — 4⅞	4⅜ — 4⅞	..	..	..	6 13 4
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..	4 12 4
290,000‡	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	107 —111	107 —111	108	..	..	4 1 1
250,000‡	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	85 — 90	85 — 90	..	..	..	3 17 9
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 5 10
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	8 %	5⅛ — 6	5⅛ — 6	..	..	..	6 13 4
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 10 11
10,852	Notting Hill Electric Lighting	10	7 %	7½%	7½%	7½%	11⅛ — 12⅛	11⅛ — 12⅛	..	..	..	6 12 0
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	7 %	5⅝ — 6⅛	5⅝ — 6⅛	5 1/8	..	..	5 12 0
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 98	94 — 98	..	..	..	4 1 8
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	12½%	10 %	10 %	7⅛ — 8⅛	7⅛ — 8⅛	7⅞	..	..	6 3 1
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	4 16 7
150,000‡	Do. do. 3½ % Deb. Stock Red.	100	3½%	3 %	3½%	3½%	85 — 90	86 — 90	..	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
50,000	Do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	70 — 74	70 — 74	..	..	— ⅛	5 8 1
65,000	South London Electricity Supply, Ord.	5	4 %	4 %	3 %	4 %	2⅜ — 2⅞	2⅜ — 2⅝	45/-	..	..	7 5 5
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	2½%	2½%	2½%	⅜ — ½	⅜ — ½	..	..	..	3 6 8
117,988	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	5 6 8
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	1 — 2	1 — 2	..	..	..	12 10 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅝ — 2⅛	1⅝ — 2⅛	40/-	37/6	..	11 1 10
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	87 — 90	87 — 90	..	..	..	5 0 0
110,000	Westminster Electric Supply, Ord.	5	14 %	12 %	12 %	10 %	7⅞ — 8	7⅞ — 8	7⅞	7 11/16	..	6 5 0
81,279	Do. do. 4½ % Cum. Pref. (Original 5 %—Red. to 4½ % from 31st Dec., 1905)	5	5 %	5 %	4½%	4½%	4⅛ — 5⅛	4⅛ — 5⅛	5 5/16	5 5/32	..	4 5 9

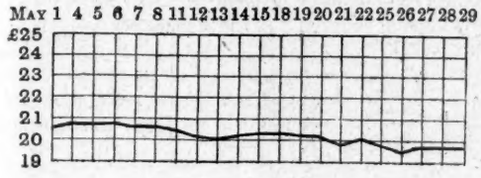
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. § Interim Dividend.

Bank rate of Discount 2½ per cent., May 28th, 1908

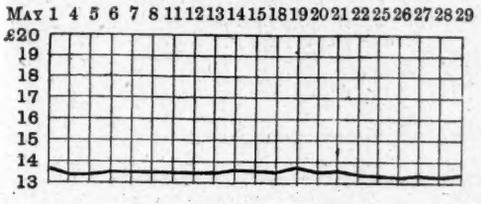
METAL MARKET.

Fluctuations in May.

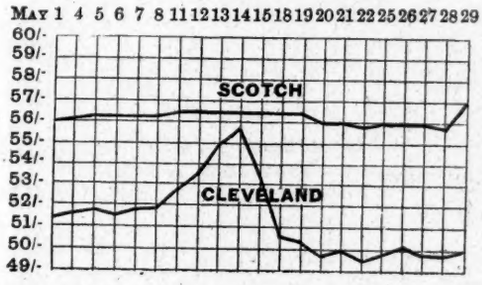
SPELTER (G.O.B's.).



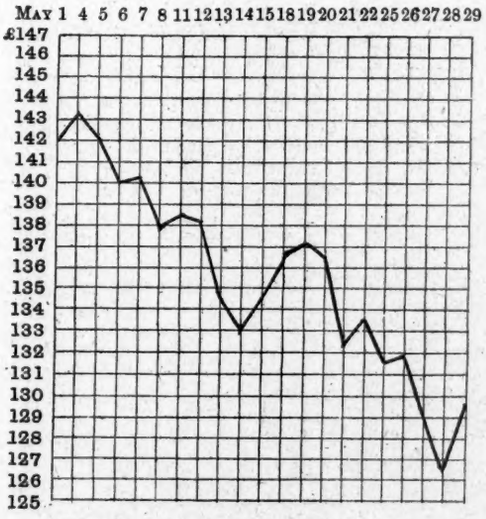
LEAD (ENGLISH).



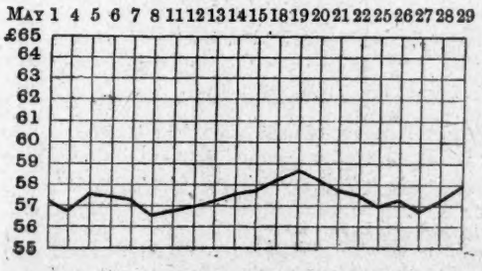
IRON.



TIN.



COPPER (G.M.B's.).



THE MEASUREMENT OF ELECTRICAL CONDUCTIVITY.

By ROLLO APPLEYARD, A.M.Inst C.E.

The following summary of the results of an extended investigation indicates the principles which I have found it practicable to apply in the design of direct-reading instruments for the measurement of electrical conductivity. For convenience, and as an example applicable to accepted specifications for submarine cables, it is supposed that the instruments are to be graduated in terms of Matthiessen's standard, but the form of the equations is unaltered by the adoption of any other standard of conductivity.

Definitions.—(1) In modern units, Matthiessen's standard for copper of 100 per cent. conductivity may be taken as representing that at 60° F. the resistance of one foot of copper wire of such conductivity, weighing one grain, is 0·2162 standard ohm. The density of copper may be taken as 8·9 at 60° F. In this form the definition is available for the usual specifications for submarine cables, corresponding to the most important practical case in which conductivity has to be determined. The resistance between opposed faces of a centimetre cube of such copper is 0·0000016944 standard ohm at 60° F., so that conversions can easily be made if desired.

(2) By the term "nominal diameter," in what follows, is meant the diameter that is ordered from the makers for a given supply of wire or rod. In practice this differs from the diameter actually delivered by the maker, and in conductivity tests the small differences have to be taken into consideration. In a similar manner, the term "nominal mass" is used to denote the ordered mass of a definite length of wire.

Classes of Instrument.—It is desirable to divide the instruments into two classes: (A) Instruments intended for measurements over a comparatively short range of conductivity, and for any required range of nominal diameter or nominal mass of wire or rod; (B) Instruments intended for measurements over an extensive range of conductivity. In this class it is generally best to restrict each instrument to

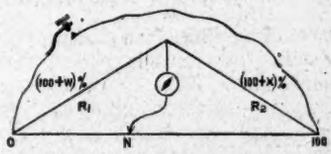


Fig. 1.

some definite nominal diameter or nominal mass of wire or rod. By modifications these two classes can be merged into one another, but for purposes of explanation they will here be regarded as distinct. In the present description of the instruments the length between potential points of the specimens tested is assumed to remain constant. It is clear, however, that by varying this length between those points the conductivity range of the instruments could be varied, and that, if necessary, the range of nominal diameter or of nominal mass could by similar means be extended.

The percentage conductivity of the standard wire or rod (fig. 1) will be represented by $(100 + w)$, that of the test-wire or rod by $(100 + x)$, and the corresponding resistances by R_1, R_2, as there indicated.

Class A. (Short range of conductivity; any diameter of wire.)—Let two wires of equal length and of equal diameter be balanced, and let the bridge-wire (fig. 1) be divided into 100 parts. Suppose balance to be at N such parts. Then—

$$\frac{R_1}{R_2} = \frac{(100 + x)}{(100 + w)},$$

and

$$\frac{R_1}{R_2} = \frac{N}{100 - N},$$

$$\therefore N = \frac{100\,(100 + x)}{200 + x + w}.$$

If w is constant, and if ΔN and Δx are extremely small, we have, in the limit—

$$\frac{\Delta N}{\Delta x} = \frac{100\,(100 + w)}{(200 + x + w)^2}.$$

Put $x = 1$, corresponding to a change of 1 per cent. conductivity for a material like copper, which has a conductivity of about 100 per cent. As an approximation we can then write, from the last equation—

$$\Delta N = 0{\cdot}25, \text{ nearly.}$$

This means that at or near the middle of such a bridge-wire each $\frac{1}{400}$th of the total length of it corresponds to a change of 1 per cent. conductivity in the test rod. A short scale so divided, and marked "100" in the middle, would therefore read directly in conductivities, with very small error, provided that all the rods or wires were of constant diameter.

Diameter Differences.—As successive test wires are never of exactly the same diameter, a compensating scale has to be designed to allow for the small differences. Assume $x = w$, but let the diameters of the standard wire and a test wire be respectively d and $(d + y)$, their lengths, as before, being equal. The condition for balance is now—

$$\frac{100 - N}{d^2} = \frac{N}{(d + y)^2}.$$

The position of balance, expressed in scale divisions, and counting from the middle of the bridge-wire, can thence be written—

$$N - 50 = \frac{50\,y}{\frac{2\,d^2}{2\,d + y} + y}.$$

If y is small compared with d—

$$N - 50 = \frac{50\,y}{d}, \text{ nearly.}$$

Put $y = 1$. Then the change in N for unit small change in d is $\frac{50}{d}$, nearly. This gives the distance through which the slider (fig. 1) must be moved from the middle position in order to compensate for unit change in diameter d. Thus, if d is in mils, $\frac{50}{d}$ scale-divisions is the required movement of the slider for a change of diameter from d to $(d + 1)$ mils. This result is general, whatever unit of diameter is employed.

Mass Differences.—Let the masses of equal lengths of the standard wire and a test wire be M and $(M + v)$ respectively. Balance on the bridge (fig. 1) is given by—

$$\frac{100 - N}{M} = \frac{N}{M + v}.$$

As it is convenient to count from the middle of the bridge-wire, this may be written—

$$N - 50 = 50\,\frac{v}{2\,M + v}.$$

When v is small compared with M—

$$N - 50 = 25\,\frac{v}{M}, \text{ nearly.}$$

Put $v = 1$, then the change in N for unit small change in M is $\frac{25}{M}$, nearly. This gives the compensating position of the slider, as in the previous case. For example, if M is in grammes, $\frac{25}{M}$ scale-divisions is the movement of the slider from its middle position to compensate for 1 gramme difference in mass between the standard wire and a test wire of equal length. This result is general, whatever unit of mass is employed. Instruments of Class A may be called conductometers.

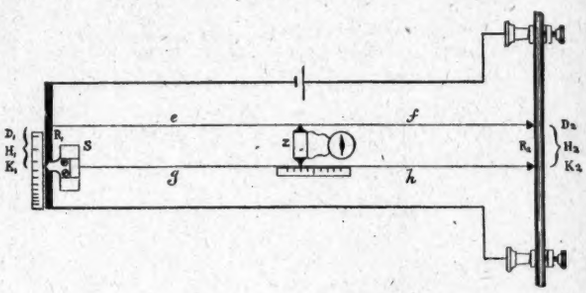
Class B. (Long range of conductivity, and one nominal diameter [D_2] of test rods).—In this class it is often desirable to arrange for the testing of comparatively short rods, and in that case the resistances of end contacts have to be eliminated, as in the Kelvin bridge. I have shown (*Phil. Mag.*, June, 1896) that in a bridge arranged as in fig. 2—assuming slider S to be fixed—for the position of slider Z which gives balance, the relation between the resistances there denoted is—

$$\frac{e}{f} = \frac{g}{h} = \frac{R_1}{R_2}.$$

Balance can obviously be obtained either by moving slider S or by moving slider Z. It will first be assumed that slider Z is fixed, and that slider S is adjusted to the position of balance. If D_1, D_2 are diameters, and H_1, H_2 the lengths of the standard rod and test rod respectively, between the points at which the potential wires e, f, g, h are attached to the rods, balance is given by—

$$\frac{H_1\,D_2^2}{K_1} = \frac{H_2\,D_1^2}{K_2},$$

where K_1, K_2 are the respective conductivities, expressed in any convenient unit. To calibrate the scale at H_1 in conductivities, find two positions H_1, H_{1a} of contact S, corresponding to two successive standard rods of known conductivities, K_2, K_{2a}, respectively. Then from the above equations—



2.

$$H_1 - H_{1a} = \left[\frac{H_2\,D_1^2\,K_1}{D_2^2}\right]\left(\frac{1}{K_2} - \frac{1}{K_{2a}}\right) = B\left(\frac{1}{K_2} - \frac{1}{K_{2a}}\right),$$

where B is *constant* and equal to $\left[\frac{H_2\,D_1^2\,K_1}{D_2^2}\right]$. It is constant because D_1 is the constant diameter of the standard rod, and D_2 the constant *nominal* diameter of the test rod; H_2 is the fixed distance between the potential points for successive test rods, and K_1 is the constant conductivity of the standard rod. As B is found by two very simple electrical measurements, none of the troublesome quantities H_2, D_1, K_1, D_2, require to be determined separately. Other points H_{1n} can subsequently be calculated from the equation—

$$H_1 - H_{1n} = B\left(\frac{1}{K_2} - \frac{1}{K_{2n}}\right),$$

and the whole conductivity scale can thus be divided to read directly in the given units.

Diameter and Mass Differences.—In fig. 2, when there is balance—

$$\frac{R_1}{R_2} = \frac{g}{h}.$$

This is an equation of exactly the same form as that corresponding to fig. 1, *i.e.*—

$$\frac{R_1}{R_2} = \frac{N}{100 - N}.$$

Consequently, the movement of slider Z (fig. 2) with respect to a scale divided in parts each $\frac{1}{400}$th of the whole length of the bridge-wire $(g + h)$, compensates for differences of diameter or of mass of the test rod exactly as in the case of the simple bridge (fig. 1); *i.e.*, the compensating setting of slider Z is $\frac{50}{D_2}$ for each unit change from D_2, or it is $\frac{25}{M}$ for each unit change of mass of the length of rod H_2 of mass M. In fig. 2, balance can be obtained either by moving slider S or by moving slider Z. It is convenient to retain Z for compensating for diameter or mass; having adjusted the position of Z for this purpose, with respect to its scale, slider S is moved until there is balance. Conductivity is then read directly from the scale of slider S.

Precision Limit.—To investigate the degree of accuracy that can be attained by the foregoing method of compensation, taking diameter differences as an example, it is sufficient first to find the error expressed in divisions of the diameter-scale z (fig. 2), and then to interpret this error as a conductivity difference. It is shown above that the true setting of slider z to compensate for a small change y in any diameter d is—

$$\left[\frac{50\,y}{\frac{2\,a^2}{2\,d+y}+y}\right],$$

but that, in general, it is sufficient to use the approximate setting—

$$\left\{\frac{50\,y}{a}\right\}.$$

The error E in the setting of scale z is therefore—

$$\text{E} = \left(\frac{50\,y}{d} - \frac{50\,y}{\frac{2\,a^2}{2\,d+y}+y}\right), \quad \ldots \quad (1)$$

where E is in divisions of scale z; and this distance has to be interpreted as a conductivity difference. With the notation used above, E can be interpreted thus—

$$\text{K}_1\,\text{R}_1 = \text{K}_2\,\text{R}_2,$$

$$(100 - \text{N})\,\text{R}_1 = \text{N}\,\text{R}_2,$$

$$\therefore \text{N} = \frac{100\,\text{K}_2}{\text{K}_1 + \text{K}_2},$$

$$\therefore \frac{\Delta\,\text{N}}{\Delta\,\text{K}_2} = \frac{-\,100\,\text{K}_2}{(\text{K}_1 + \text{K}_2)^2}, \text{ nearly.}$$

Put $\Delta\,\text{K}_2 = 1$, and let $\text{K}_1 = \text{K}_2$. Then—

$$\Delta\,\text{N} = -\,\frac{25}{\text{K}_1}, \text{ nearly,}$$

or a change of conductivity from K_1 to $(\text{K}_1 + 1)$, expressed in any unit of conductivity, can be balanced by moving the slider z along its scale through a distance—

$$\Delta\,\text{N} = -\,\frac{25}{\text{K}_1}. \quad \ldots \quad \ldots \quad (2)$$

From equations (1) and (2), by putting $\text{E} = \Delta\,\text{N}$, the error E can be expressed as conductivity.

Example.—Let the nominal diameter, d, of any given rod be 220 mils; and, as an extreme case, let the difference of diameters be $y = 10$ mils. Putting these values into

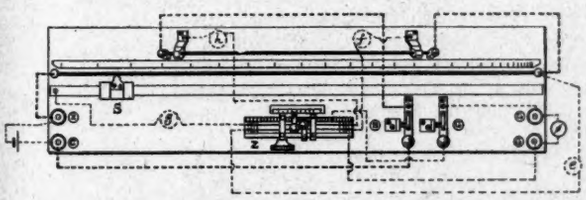


Fig. 3.

equation (1), we find E = 0·052 scale-divisions at z. Let the conductivity of the rod be, say, 10 per cent., then $\text{K}_1 = 10$; and from equation (2), $\Delta\,\text{N} = \frac{-25}{10} = -\,2{\cdot}5$, *i.e.*, a change of 1 per cent. conductivity from 10 per cent. is balanced by a movement of slider z through 2·5 divisions. Consequently, 0·052 divisions of the diameter scale correspond to $\frac{0{\cdot}052}{2{\cdot}5} = 0{\cdot}021$ per cent. conductivity. This, therefore, is the conductivity error to be expected in an extreme case. In an actual instrument tested at the National Physical Laboratory the error was found to be "practically within the limits of errors of observation." The method of compensation can consequently be accepted as trustworthy.

The mechanical details of an instrument of Class A type, the conductometer, were described in the *Proceedings* Inst.C.E., Vol. CLIV., Part IV, 1902-3, and an account of an instrument of Class B type was given in *Proceedings* Inst.C.E., Vol. CLXIV., Part II, 1905-6. In its final form the Class B instrument is shown in fig. 3, which is drawn to correspond with fig. 2. The contact-piece s slides along a thick copper bar, which is parallel to the long scale from which conductivities are read. Only a few inches of the wires *e*, *f*, *g*, *h* (fig. 2) are exposed; the remaining portions are wound upon the bobbins *e*, *f*, *g*, *h* (fig. 3). The exposed portions are fixed parallel to one another under the double slider z, which can be set to its appropriate position with respect to the small scale shown just above it. Slider z is set by a rack and pinion movement, through the distance required to compensate for differences of diameter or of mass. Balance is then obtained by moving slider s, and conductivity is read directly off the long scale. The rod to be tested is gripped as represented in fig. 2, and the potential clips which terminate *f* and *h* are constructed as in fig. 4. This

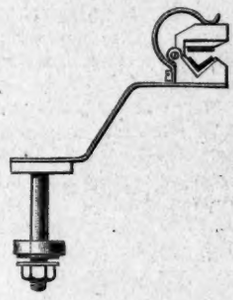


Fig. 4.

arrangement is sufficiently flexible to allow for slight bends in the test rods, and successive rods can be easily inserted or removed. In instruments of both classes all arithmetic is avoided, and the wires are not cut off the hanks; the results are obtained at the rate of two or three rods or wires a minute, as direct conductivities.

It is clear that the principles above described could also be applied to instruments making use of the Kelvin and Varley slide.

REVIEWS.

Reply to Criticism of the Murray Automatic Printing Telegraph System.

This communication, published under the auspices of the Institution of Post Office Electrical Engineers, is in defence of the Murray telegraph system, which the author, who is the inventor, considers to have been unfairly treated in a paper on the Baudot system by Mr. A. C. Booth, one of the members of the Institution.

The criticism was a comparison between the Baudot printing telegraph, which is a multiplex system giving from two to six channels, each working at a speed of 30 words per minute, and the Murray automatic, working in practice at a speed of 100 to 120 words per minute. Altogether, the criticism occupied about three pages, while the inventor's reply occupies 26 pages, and the two form very interesting reading to anyone having a good knowledge of both systems.

It is observed that on the cover of the communication the Council of the Institution disclaims responsibility for the statements made, or the opinions expressed.

After a few generalities the meaning of the scientific terms, "Synchronous" and "Isochronous," are dealt with at some length. Mr. Booth holds the view that neither term is applicable to the Baudot, while Mr. Murray contends (see his 1905 paper before the Institution of Electrical Engineers) that the Baudot, as usually worked, is "synchronous," and his own system "isochronous." For this reason he claims that the latter is superior to the Baudot. On the other hand, it is stated that the Baudot can be worked as an isochronous system, and this can be done by simply turning one or two keyboard switches. Now as the speed, lag and phase are identical in both cases, Mr. Murray's statement conveys the impression that synchronism and isochronism are the same when applied to Baudot.

We are inclined to the opinion that in both methods of working the Baudot is isochronous.

The question of duplexing the Baudot system is then dealt with rather extensively, the object being to show that nothing would be gained thereby. The varying balance is mentioned as the chief objection; but on reference to Mr. Booth's paper we find that the duplex is only suggested for the underground loop circuits which are free from inductive disturbance, line variation, and balance troubles; such circuits would, of course, be steadier and more reliable than two single aerial lines with inductive disturbance and varying insulation.

The carrying capacity of the different systems is then objected to on the ground that Mr. Booth's figures are a mixture of actual and estimated results, while some of them are taken from circuits dealing with international messages and others with inland messages only.

In this respect we agree with the objection, unless a proper allowance was made in the "good average" figures quoted. There is nothing to show whether this has or has not been done.

Next follows a very long argument over the extra signals required on the two systems. In the first case the number of extra signals is taken from an actual working set, but this is objected to as being incorrect, and very much lower figures are quoted, giving the Murray a 20 per cent. advantage over the Baudot quadruple simplex.

Assuming this to be correct, some explanation is required as to why a quadruple Baudot working at 120 words per minute can deal with 300 messages in one hour, and the Murray duplex at 200 words (100 each way), and having a 20 per cent. advantage in the matter of additional signals, has only dealt with 287 messages in the hour.

The 20 per cent. advantage might perhaps have been neutralised by the repetition of figures and difference in length of messages; but even with that allowance, it seems that the Murray should have dealt with something like 500 messages instead of 287 as a maximum. The reason put forward by Mr. Booth, that the use of the Morse key lowered the output very much, could hardly account for the drop of 213 messages.

Later on Mr. Murray says that 400 messages in one hour could have been dealt with if there had been sufficient traffic, yet he does not dispute the accuracy of Mr. Booth's maximum figures, viz., 150 simplex, 287 duplex. There is evidently something wrong here. If 400 could be done in the hour, then the maximum figures should have been somewhere in that region also.

Another point on which we are unable to follow Mr. Murray relates to the limiting speed of his printers preventing any high-speed work. We understand, and he states, that each Murray set is equipped with two printers, both independent of the line; that is to say, the available printing speed is 200 words per minute, and not 100.

In several places it is stated that the Murray is most suitable for long lines, and at the bottom of page 8 that "for telegraph traffic over moderate distances the multiple principle is better than the automatic." Both of these statements seem to coincide with the opinion of Mr. Booth's comparison, that for the British Post Office service the Baudot holds the premier position for printing telegraphs.

In our opinion, Wheatstone at from 300 to 400 words per minute (Wheatstone has reached 650 per minute) can deal with far more traffic than either Baudot or Murray; but there are, of course, other disadvantages.

Finally, in regard to the use of the Morse key on the Murray automatic system, it is contended that there is no necessity for this, it being "purely a matter of traffic convenience and practical common-sense." It is not quite clear whether Mr. Murray intends to admit, in such a curious way, the necessity for the use of the Morse key, or to suggest that his system should be worked on other than practical common-sense lines.

The following particulars supplied by a high official of the French service regarding the Baudot sextuple working between Paris and Marseilles may be of interest to our readers:—

"The sets were installed in the year 1900, and have given excellent results. The lines are each 590 miles long, with a repeater at Lyons. The regulation is a little more delicate than that required for the quadruple, but no trouble is experienced in this respect. Faults do not occur more frequently than in quadruple sets.

"The number of messages dealt with by the two circuits averages 4,400 per day, but has reached 8,000 in the day. These figures include the numerous Press telegrams for the Region du Midi and parts of Algeria and Tunis. Each of these messages contains about 200 words, and many exceed that number, but are counted as single messages in the above results."

CHARGES FOR ELECTRICAL ENERGY.

[BY OUR LEGAL CONTRIBUTOR.]

The correspondence which has recently appeared in these columns under the above heading may not unnaturally turn the attention of our readers to the legal aspect of the case. It seems that the introduction of metallic-filament lamps has been a boon to the consumer but a source of loss to the supply company. Indeed, every improvement which tends in the direction of increased lamp efficiency has a prejudicial effect upon the revenues of the central station.

Do the Electric Lighting Acts provide any redress? Take an extreme case. Suppose that, under their provisional order, a supply authority are at liberty to charge 6d. a unit. Calculation shows that they can charge the consumer 2d., and yet make a profit. Suddenly a new lamp appears on the market, which enables the consumer to get the same amount of light by the purchase of half the amount of energy. A large number of the consumers adopt the new form of lamp. Has the supply company any right to raise the price to those who adopt the new system? To raise prices all round might be a serious matter, having regard to the competition of gas; the question is whether a company can make any increased charges to those of their consumers who have adopted the new and more economical form of lamp.

The Electric Lighting Act, 1882, would seem to have been drafted by some gentlemen, who, in the interest of the consumer, had some preternatural foresight on this question. It is not always that a statute is found to make provision for knotty questions arising some 26 years after it receives the Royal assent. But the Act just mentioned would seem at first sight to be an exception to the general rule.

In the first place, it is clear that the company cannot insist upon any particular kind of lamp being used. Thus, by Sec. 18 of the Act of 1882, it is provided that, "The undertakers shall not be entitled to prescribe any special form of lamp or burner to be used by any company or person, or in any way control or interfere with the manner in which electricity supplied by them under this Act, and any licence, order or special Act is used: Provided always that no local authority, company or person shall be at liberty to use any form of lamp or burner or to use the electricity supplied to them for any purposes, or to deal with it in any manner so as to unduly or improperly interfere with the supply of electricity supplied to any other local authority, company or person, or by the undertakers." It is clear that by the first part of this section, a company would have no authority to decree that metallic-filament lamps shall be used. The proviso to the section does not in any way help the companies; for the use of this particular kind of lamp cannot be said to "interfere with the supply of electricity to any other local authority, company or person."

One other section of the Act merits attention in this connection. Sec. 19 provides that "where a supply of electricity is provided in any part of an area for private purposes, then, except in so far as is otherwise provided by the terms of the . . . . order . . . . authorising such supply, every company or person within that part of the area shall, on application, be entitled to a supply on the same terms on which any other company or person in such part of the area is entitled under similar circumstances to a corresponding supply."

What, then, are "similar circumstances?" Were it not for the lamp clause above referred to, it might well be argued that a person who took current at 2d. a unit for a metallic-filament lamp did not take a supply under circumstances similar to those under which a supply is granted to the owners of older lamps. The Court has taken a broad view of Sec. 19; in Metropolitan Electric Supply Co. *v.* Ginder ((1901) 2 Ch. 799) an intending consumer signed a form of request to an electric lighting company subject to, *inter alia*, the following terms:—(1) The consumer agrees to take the whole of the electric current required for the premises mentioned below from the company for a period of not less than five years. (2) The charge for electric energy to be 4½d. per Board of Trade unit. No quantity was specified; there was no covenant by the company to supply nor by the defendant to take any energy. Similar forms of request had been signed by other persons for different terms of years, and at different prices. The company afterwards supplied another consumer under contract for two years at 4d. per unit; but he was a large consumer, and took his supply in the daytime, which was an advantage to the company. It was held that this did not amount to undue preference under Secs. 19 and 20 of the Act of 1882; that the phrase, "special circumstances," in Sec. 19 embraced amount of energy consumed, the expense of supplying it and getting payment; uniformity of demand and the fact that some consumers required the energy by day and some by night, and that unless all the circumstances were similar, agreements might lawfully be made for different terms and at different rates. The contract (the terms of which were embodied in the form of request) contained no negative covenant not to take electric energy from any other source. The consumer having given to the company notice to remove their meter, Mr. Justice Buckley granted an injunction at the instance of the company, holding that the negative covenant was to be implied.

Having regard to the foregoing case, which shows that the term "similar circumstances" is to receive a wide construction, would it be possible for a supply authority to divide its consumers into two classes, namely, those who do and those who do not use metallic-filament lamps, and make a special charge to persons in the former class? The question resolves itself into this: Would it be "prescribing a special form of lamp" for a company to say, "You shall not use lamp A, except upon the terms that you pay 4d. a unit; for current supplied to any other form of lamp we shall only charge you 2d." The consumer receiving such a notice would be at liberty to use any other form of lamp at the lower rate; and if the Court found that, taking everything into account, in either case the cost of lighting was the same whether the new form or the old form of lamp was used, there could not be any undue preference. Having regard to the enormous interests at stake, it would be of great interest to see what the Courts would have to say upon the construction which we venture to think might be put upon Sec. 19. One must not, however, lose sight of the other part of the section, which says that the company must not "interfere with the manner in which electricity supplied by them under the Act is used."

PROCEEDINGS OF INSTITUTIONS.

Comparison of the Board of Trade Ampere-Standard Balance with the Ayrton-Jones Current-Weigher.

By T. MATHER, F.R.S., and F. E. SMITH, A.R.C.S.

(*Abstract of paper read before the* ROYAL SOCIETY, *March 26th*, 1908.)

WHEN the Board of Trade ampere balance was set up and verified in 1894, the platinum weight (marked A) used with the instrument was adjusted so that a current which deposited silver from a 15 per cent. solution of silver nitrate at the rate of 1·118 milligrammes per second, produced, on reversal, a change of force equal to the weight of A. At that period such a current was believed to represent *the ampere*, viz., 1/10 of a C.G.S. unit, with a fair degree of accuracy.

During the last few years a new current weigher, designed at the Central Technical College, has been constructed at the National Physical Laboratory with a precision previously not obtained in any instrument for the absolute determination of current strength, and by means of it the electro-chemical equivalent of silver has been determined to a very high degree of accuracy. We therefore considered it of interest to determine the difference between the units of current as measured by the two balances, and at the same time ascertain how nearly the ampere, as measured by the Board of Trade balance, deposits silver at the rate of 1·118 milligrammes per second.*

The comparison of the two balances was carried out by the aid of cadmium cells and resistances used as secondary standards of current; for example, if a current be passed through a resistance, and the strength of the current adjusted until the potential difference between the terminals of the resistance is equal to the E.M.F. of a standard cell, then, when the cell and coil are at given temperatures, a perfectly definite current must be passing through the coil. If this current be determined in absolute measure by means of a current weigher, such as described in the paper previously mentioned, the combination of cell and coil is standardised, and can be used subsequently as a secondary standard of current. Knowing the relations between E.M.F. and temperature for the cell, and between resistance and temperature for the coil, the current required to produce equality of P.D. and E.M.F. at any given temperatures can be found. The combination of cell and resistance can, therefore, be used as a secondary standard of current, at temperatures other than those at which they were standardised.

After standardising the combination of cell and resistance by means of the Ayrton-Jones current weigher at Busby, they were taken by hand to the Board of Trade Laboratory at Whitehall, and set up in a circuit including the Board of Trade balance.

Two methods of comparison were made use of.

The results of the tests are given in the following table. From this it will be seen that the currents, as measured by the Board of Trade balance, are approximately $0{\cdot}03_8$ per cent. higher than their values in terms of the Ayrton-Jones balance. *The Board of Trade ampere is therefore about* 1/30 *per cent. smaller than* 1/10 *of the C.G.S. unit of current as realised by the Ayrton-Jones current weigher.* A difference of this order of magnitude was anticipated by the authors, for the new determination of the electrochemical equivalent of silver, previously referred to, gives 1·11827 milligrammes of silver per coulomb, whereas the Board of Trade ampere was intended to be such as would deposit 1·118 milligrammes per second.

No. of experiment.	Date.	Method used.	Value of R (average).	Current as measured by		Percentage difference.
				Board of Trade balance.	Ayrton-Jones balance.	
1	6.1.08	Added weights	—	$1{\cdot}0186_1$	1·01836	$0{\cdot}02_4$
2	7.1.08		—	$1{\cdot}0188_8$	1·01838	$0{\cdot}04_4$
3	,,	1-ohm coil shunted	632	1·0000	0·99970	$0{\cdot}03_0$
4	8.1.08		633	$1{\cdot}0000_6$	0·99973	$0{\cdot}03_3$
5	,,		730	$0{\cdot}9998_7$	0·99951	$0{\cdot}03_6$
6	,,		696	$0{\cdot}9998_5$	0·99956	$0{\cdot}02_9$

Average of 1 and 2 ... ... = $0{\cdot}03_4$
,, 3, 4, 5 and 6... ... = $0{\cdot}03_2$.

The percentage difference between the two numbers 1·11827 and 1·118 is $0{\cdot}02_4$, and this differs from $0{\cdot}03_3$ per cent. by $0{\cdot}00_9$ per cent., or less than 1 part in 10,000. *We, therefore, conclude that the Board of Trade ampere is equal to the international ampere, as defined by silver deposit, within* 1 *part in* 10,000, *i.e., within* 1/100 *part of* 1 *per cent.*

This result is highly satisfactory, seeing that the instrument was set up about 14 years ago. It reflects great credit on the gentlemen responsible for the adjustment, and shows that the care and skill with which the work was carried out was of a very high order. The very close agreement also supplies evidence in favour of the constancy of instruments of this class, and confirms the decision arrived at by the committee of 1891-4, that the principle of the balance was the best one to employ. It also gives support to the opinions of Prof. Ayrton and the authors, formed after an extensive experience with the Ayrton-Jones balance, that *current weighers properly designed and constructed are the most satisfactory standards of current.*

It is interesting to notice that, according to these experiments, the Board of Trade ampere will deposit silver at the rate of $1{\cdot}11827/1{\cdot}0003_8$, *i.e.*, $1{\cdot}1179_1$ milligrammes per second—a value which is nearly identical with the number $1{\cdot}1179_4$ given by Lord Rayleigh and Mrs. Sidgwick in their classical memoir of 1884.

APPENDIX.

In a previous paper on "A New Current Weigher, &c.," by Prof. Ayrton and ourselves, we have shown that the E.M.F. of the normal cadmium cell, in terms of the ampere as given by the Ayrton-Jones balance and the international ohm as realised at the National Physical Laboratory, is 1·01830 at 17° C., and for the normal Clark cell the value is $1{\cdot}432_8$ at 15° C.

A comparison of resistances made by one of us (F. E. S.), in 1903, gave the following relation:—

1 N.P.L. international ohm = $1{\cdot}0001_5$ Board of Trade ohms; and, as above, 1 Ayrton-Jones ampere = $1{\cdot}0003_8$ Board of Trade amperes.

The ratio between the values of C × R is therefore $1 : 1{\cdot}0001_5 \times 1{\cdot}0003_8$, *i.e.*, $1 : 1{\cdot}0004_6$;

* We may here remark that the official limit of accuracy applied to the Board of Trade *standard* of current (not to the instrument is one-tenth part of 1 per cent. See order in Council, 1894.

hence we find that the E.M.F. of the normal Weston cell is

$1{\cdot}01830 \times 1{\cdot}0004_8$ Board of Trade volts,*

$= 1{\cdot}0187_9$ Board of Trade volts at 17° C.

Reducing to 20° C. by the accepted formula, we get—

E.M.F. $= 1{\cdot}0186_8$ Board of Trade volts at 20° C.

The value published by the Reichsanstalt is 1·0186 volts at the same temperature.

For the normal Clark cell we have—

E.M.F. in Board of Trade volts $= 1{\cdot}432_8 \times 1{\cdot}0004_8$ at 15° C.

$= 1{\cdot}433_0$ "

This value is in good agreement with the number 1·4329 determined directly by Mr. Trotter at the Board of Trade laboratory in 1904.

It is gratifying to find such a close approximation between the results obtained in the two distinct ways.

The Pyrometric Installation in the Gun Section, Royal Gun and Carriage Factories, Woolwich.

By WESLEY LAMBERT, F.C.S., Chief Metallurgist, Royal Gun Factory, Woolwich.

(*Abstract of paper read before the* IRON AND STEEL INSTITUTE, *May*, 1908.)

THE introduction of the system about to be described, though only including a single type of pyrometer, has for its sole objective the control of the thermal treatment of the steel to be subsequently used in the construction of ordnance. Such thermal treatment for the purposes of this description is held to comprise the heating of the steel for forging operations under the steam hammer or hydraulic press, together with the subsequent annealing, oil-hardening, tempering and shrinkage operations.

The temperature control of the whole of these operations in the treatment of ordnance steel is admittedly one of great importance, and too much care and consideration cannot be bestowed upon the selection and installation of a properly devised pyrometric system of control.

To Col. Holden, F.R.S., R.A., the present superintendent of the Royal Gun and Carriage Factories, must be accorded the credit of introducing to the department the instrument now in use.

The thin edge of the wedge, which in course of time has dislodged all the other forms of pyrometers in the department in favour of the thermo-couple, was the introduction in 1900 of the simple instrument of the indicating pattern supplied by Messrs. James Pitkin & Co., of Clerkenwell, London, E.C.

The rapidity with which the temperature was "picked up" and any fluctuations in the heat bath indicated, at once established its utility and installed it in the favour of those officials in the department interested in high-temperature measurement.

A suitable couple consists of a pure platinum wire together with a wire of 10 per cent. iridio-platinum alloy, and thermo-couples of these two metals are used exclusively throughout the present installation.

The galvanometer is of the reflecting type and of simple construction. It is a modification, devised by Col. Holden over twenty years ago, of the D'Arsonval galvanometer.

This form of galvanometer is particularly adapted for this class of work, and is practically dead-beat. Its internal resistance is about 80 ohms.

This was the first contribution to the present-day installation, and was reserved for ascertaining the temperature of the lead bath for heating test-specimens. A second instrument was ordered for use at the big furnaces of the oil-hardening and annealing section.

Closely following this second instrument, a further addition was introduced, an instrument of the recording pattern, made by the same firm, to the specification of the instrument used by the late Sir W. Roberts-Austen, and designed for his work at the Mint by Colonel Holden. This instrument, necessitating some slight knowledge of photography—the record being a photographic one—was handed over to the metallurgical laboratory.

Some slight trouble was experienced through vibration; but this was successfully overcome by suspending the galvanometer from a tripod in such a manner that the vibration was absorbed by three small spiral springs so arranged as to be in partial compression. This method of suspension has proved an admirable one, and has been adopted throughout the system.

These three instruments formed the nucleus of what is now regarded by experts as one of the most complete pyrometric installations in the kingdom.

The recording pyrometer consists of two light-tight mahogany cases, the larger of which contains a Holden-d'Arsonval dead-beat galvanometer similar to that used with the indicating instrument, with a suitable arrangement of lenses, mirrors, &c. The other case contains a drum which is made to revolve by contained clockwork, and is covered with sensitised photographic paper. A ray of light is thrown on to the mirror of the galvanometer, and is projected thence on the sensitised paper. The galvanometer is then connected by copper leads to a thermo-junction inserted in the place, the temperature of which it is wished to record.

A scale is also provided on which the temperatures can be read without interfering with the record.

Two recording instruments of this type are in constant use day and night, and constitute the laboratory end of the system. These two recorders are also regarded as the standard instruments of the department. They are mounted on simple iron pedestals, the galvanometers being suspended inside the cameras from their respective tripods.

The following branches are now wired up to and are under pyrometric control from the metallurgical laboratory—the heavy forges, the oil-hardening and tempering branches, the case-hardening shop, the drop-forging plant, the lead bath (specimen treatment plant), and the gas muffles throughout the department used by the tool-smiths and other craftsmen. The various sections of the gun department are in direct telephonic communication with the laboratory. Each of the larger sections previously named has an independent instrument room fitted with a simple indicating instrument.

The temperature of boiling water is taken as a common zero for the temperature scale of the whole of the instruments comprising the installation.

A vessel of boiling water is used, in which a naked thermo-junction is placed; the glass scale upon which the reading beam is thrown being adjustable to the left or right, a slight movement serves to re-establish the zero.

The leads from the pyrometer cabins to the metallurgical laboratory are of Siemens Brothers "T. 5" flexible twin cable, carried overhead as in telephone wiring.

The standard instruments are calibrated by the arrest representing the boiling point of water as zero, and the freezing points of the following substances:—

Substance.	Degrees C.	Degrees F.
Tin	232	450
Lead	327	621
Zinc...	419	786
Aluminium	657	1,215
Sodium sulphate	860	1,580
Copper	1,084	1,983

Observations are taken of the cooling of the metal, the temperature of solidification being indicated by the arrest in the downward movement of the beam of light upon the glass scale. From the points thus obtained an interpolation curve is constructed.

The sensitised bromide sheet after a 24 hours' run on the drum is removed, carefully excluding actinic light, and placed in a printing-out frame, containing a sheet of plate glass, the inner side of which is painted black and upon which surface longitudinal and vertical lines are scratched, in such manner that upon exposing the frame to active light, lines representing both periods of time and temperature are printed. Common flashed ruby-red glass may be substituted for the painted glass, the lines being etched upon the ruby surface by exposure to the action of hydrofluoric acid. The exposed paper is then developed, fixed, washed and dried, dated and forwarded to the responsible foreman of the particular section for whom the record is intended. Each sheet represents a day's record in the form of curves of the temperatures of the various forgings treated in the furnaces of the section during the preceding 24 hours (fig 2).

A simple plug board of a double-pole pattern is employed, to the back of which the respective leads from each furnace are conducted. These leads are of S.W.G. No. 18, of tinned-copper wire, insulated with pure and vulcanised india-rubber, taped and braided. Each pair of leads is enclosed in common gas or steam barrel, which is maintained throughout the whole circuit from the furnaces to the pyrometric cabin of each branch. The short flexible portion of the leads at each furnace, by which connection is made to the pyrometers in the furnaces, is protected by an asbestos covering, thus preventing any liability of faulty insulation by the scorching of the ordinary coverings. Two plugs suspended on short flexible leads serve either to connect the pyrometer cabin or to transmit the thermo-electric current to the recording instrument in the metallurgical laboratory.

The metallurgical laboratory being situated at some distance from the sections previously named, the resistance of the conducting leads is carefully measured, and in calibrating the instruments due allowance is made for this. Moreover, with each galvanometer a considerable predetermined series resistance is used, approximating some 500 to 600 ohms, and with such a resistance the slight differences in the lengths of the leads from the furnaces are not sufficient to impair the accuracy of the readings.

The method of ensuring that, as far as possible, the actual temperature of the article heated is ascertained, as distinct from the temperature of the furnace itself, is by sheathing the pyrometer tube in a circular muffle of non-conducting material in such a manner that the extreme end of the pyrometer, which is in close proximity to the couple itself, shall be in actual contact with the articles. The muffle ensures the absence of any false reading due to the temperature of the gaseous atmosphere of the furnace being conducted down to the thermo-couple.

For use at the forge reheating furnaces, the temperature of which approximates 1,100° C. (2,000° F.), these muffles are built up of hollow refractory fireclay cylinders or sleeves, similar to those used to protect the swan-neck stopper bar of the ordinary steel-casting ladle. These cylinders are luted together, and the whole heavily coated with refractory composition, which is then dried and baked. At the furnaces of the oil-hardening section, there being no occasion for long-sustained high temperatures, the protecting muffle is constructed from mild steel tubing varying according to the size of the furnace from 3 to 6-in. bore, and having centring disks placed at regular intervals along the interior to admit of the insertion of

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* The Board of Trade volt being defined as the P.D. between the terminals of a resistance of 1 Board of Trade ohm when a current of 1 Board of Trade ampere is passing through it.

an inner tube concentric with the outer one, and of sufficiently large bore to freely admit the insertion of the pyrometer. The annular space between the inner and outer tubes is tightly packed with well-dried asbestos fibre. These muffles vary in length from 3 to 8 ft., as demanded by the nature of the work and the size of the furnace.

As many as five and six thermo-couples are sometimes inserted in the long vertical furnaces of the oil-hardening section employed in heating the larger forgings forming the inner tubes of the heavier guns. These gun tubes in the larger nature of ordnance sometimes exceed 60 ft. in length. The furnaces are gas heated, and by means of air ports combustion may be regulated with great uniformity, especially when controlled by a number of thermo-junctions placed at regular ascending intervals in the walls of the furnace.

At the forge reheating furnaces, each of which is fitted with independent leads, the sheathing muffle is introduced through a hole in the crown of the furnace roof.

As far as possible, the cold junction of each couple with the pyrometer leads is maintained at an equable temperature approximating to the normal atmospheric temperature; (*a*) by having sufficiently long pyrometers, the wires of the couple being threaded right through from the hot-junction to the head of the instrument, the latter being protected by asbestos screens wherever found necessary; (*b*) by calibrating the whole system with an allowance for the average cold-junction temperature of the various pyrometers in use throughout the system as ascertained by thermometric observations.

The details of the actual construction of the pyrometers in use are as follows:—

The ends of the couples are twisted together for a length of $\frac{3}{10}$ths of an inch; the twisted junction is then "autogene" soldered by holding the ends in the oxyhydrogen flame until they become fused to a small globule (1, fig. 1). This method of securing the ends has proved very efficient, as merely twisting the ends results, after repeated heatings of the same couple, in loose contacts, and leads to false readings from time to time, according as the contact happens to be good or indifferent.

The unsecured ends of the wires of the couple are then threaded through the double-drilled porcelain tube of highly refractory clay

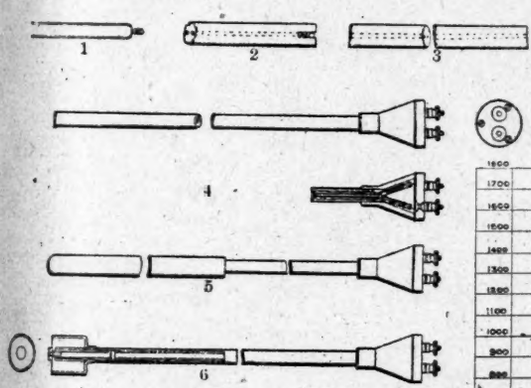

Fig. 1.—Details of Construction of Pyrometers.

(3, fig. 1), care being taken that the wires at each junction of the short lengths of the insulating tubes are not twisted, thereby forming a false contact. This refractory covering, together with the couple wires, are maintained throughout the whole length of a pyrometer, even should this approximate 15 or 16 ft. in length, as is actually the case in the longer forms. The wires in the head are wound into two spirals, which are insulated from each other by short lengths of rubber tubing. This affords a few inches of spare wire, use of which is made from time to time as necessitated by the re-making of a new junction, &c. (4, fig. 1).

The double-drilled fireclay tube, immediately at the junction end of the couple, is sawn through longitudinally for a short distance, just sufficient to little more than cover the end of the junction (2, fig. 1), thereby preventing liability of any contact between the couple and the welded end of the iron sheath. The head is of cast metal, bored and tapped to fit the iron sheathing. The cover of the head carries the two terminals by which the wires of the couple are connected to the galvanometer leads. It is made of ebonite, and simply fastened by three screws, as shown in 4, fig. 1. The iron sheathing is ordinary ¾-in. gas barrel. For use at the lead bath the sheathing is a solid-ended tube bored from mild steel rod, and of such length as to be well above the surface of the molten lead, and joined on to a length of gas barrel sufficiently long to ensure the head being well removed from the source of heat. Welded tubes have not proved satisfactory in use at these baths on account of the lead finding its way through after being in use but a short time (5, fig. 1). The life of the iron sheathing for ordinary furnace work is considerably prolonged by the use of the muffles already mentioned, which, of course, must obviously protect the pyrometer from the more or less oxidising atmosphere in the furnace.

It is advisable to remove as much scale as possible from the bore of the gas or steam barrel before welding up the end, as any excessive scale on the inside tends at high temperatures to frit with the porcelain insulating tubes, and renders stripping of the couples for repair or examination a difficult task.

The more secure the protection of the wires of the couple from the influence of the furnace gases, the more immune to changes in thermal value is the wire itself. Upon exposure at long-sustained high temperatures more or less crystallinity of the platinum and iridio-platinum wires takes place. Neither the thermo-electric value nor the conductivity is materially affected by slight changes of this nature.

Excessive crystallinity, however, renders the wire brittle, and necessitates careful handling and frequent inspection when this occurs. The pyrometer should be temporarily withdrawn from use and the couple stripped. The malleability of the wire may be restored by momentarily glowing to incandescence. This is best done by passing a heavy current of electricity through the wire. If this is not convenient, the brittle portion of the wire may be cut off and the wires pulled down from the head, for which purpose the spirally coiled length at the end of the wire is provided, or failing sufficient length to allow of shortening the wire the whole couple may be transferred end for end.

The gauge of the platinum and the iridio-platinum wires employed throughout the installation in making up the couples is of a uniform size, viz., 25 s.w.g., and it was found of considerable advantage to secure a sufficiency of the wires in single coils for the whole installation, with a considerable reserve for the upkeep of the same and for any additional extension of the system that might be necessitated in the near future.

The advantage in securing a single coil of each of the wires is evident. It favours the chances of the metals being of the same composition throughout and of the same thermo-electric value, which is more than one can hope for in buying short lengths from time to time. Too much care, however, cannot be expended in satisfying oneself that each couple made up is practically of the same thermo-electric value, as otherwise the calibration of the instruments does not hold good for the whole of the pyrometers throughout the system.

The variableness of the coil of wire may be tested on its receipt by cutting off portions from each end of a coil, twisting the ends of the *similar* metals together, and connecting the free ends to the galvanometer. On applying heat to the junction no appreciable movement on the galvanometer scale should be observable, thus demonstrating the purity or uniform composition of the wire.

There still remains a form of pyrometer which is in daily use for ascertaining shrinkage temperatures in the building up of ordnance, &c., and also for ascertaining the given temperature

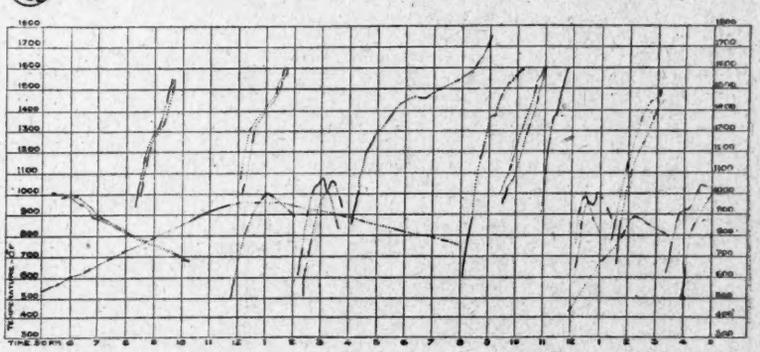

Fig. 2.—Sample Chart.

below which it is not deemed desirable to put further work upon a forging. This couple is similar in most respects to those previously described, but differs in one important feature.

The fire end of the couple terminates in a small exposed platinum plate made up of two small circular disks, $\frac{1}{16}$ of an inch in diameter, of sheet platinum, between which the wires of the couple are led, and the two disks secured by riveting each to the other. This small plate or disk standing proud of the end of the pyrometer is supported some distance from the end of the tube by a small spiral spring, thus ensuring a good contact when the couple is pressed to the face or side of the heated body. The platinum plate serves as a collecting disk, and being very light and small almost instantly acquires the temperature of the heated mass, and being itself the actual hot-junction proves a most efficient thermo-couple. The general construction of this form of pyrometer will readily be understood by reference to 6, fig. 1.

Steam Turbines for Mill Power.

At the annual meeting of the National Association of Cotton Manufacturers, held in Boston on April 16th and 17th, a paper was presented on "Steam Turbines for Textile Mill Power," by Mr. M. H. Merrill, of the Westinghouse Electric and Manufacturing Co. The author emphasised the degree to which the electric drive has now become standardised, and pointed out that in point of reliability, simplicity in operation, uniformity of speed, and economy, the steam turbine stands pre-eminent, except where the conditions

favour the use of the gas engine. In the cotton mill, many different processes depend upon the continuity of service of the power plant, and any variation in speed affects the productive capacity of the installation. The turbine is valuable, not only in economy of fuel, but in all attending expenses—foundations, space, supplies, maintenance, attendance, and fixed charges on the investment.

A large part of the paper was given up to a detailed description of the Westinghouse-Parsons turbine. Mr. Merrill laid stress on the multiple-stage construction of the Parsons turbine, stating that complete expansion of the steam is effected from the boiler to the condenser pressure, without exceeding at any point in the expansion a velocity of 600 ft. per second, or about 450 average, compared with 4,000 in a single-bucket wheel, and about 2,000 in the turbine of not more than four stages. Several machines of 10,000 KW. capacity are under construction for the Kent Avenue station of the Brooklyn Rapid Transit Co. These machines represent the largest single turbo-units ever constructed for power work, and will have an overload capacity of 22,000 B.H.P., which would be equivalent to an output of 25,000 I.H.P. in the reciprocating engine. In the last year a special material, known as duplex metal, has been developed for the blading of these turbines. It combines the strength of steel with the protective qualities of the copper sheath, especially against chemical erosion.

Positive ventilation is perhaps the most important feature of the Westinghouse turbo-generator. During a serious accident occurring last year at the Waterside station of the New York Edison Co., a 7,500-KW. turbine carried an overload of practically 80 per cent. for one hour and twenty minutes.

Among other tests, one recently made upon a cotton mill installation was presented. A 500-KW. Westinghouse-Parsons turbine was used, working with steam pressure 170 lb. per sq. in., vacuum 27·5 in.; the average load was 313 KW., and the steam consumption per KW.-hour was 24·56 lb.

The paper concluded with emphasis upon the self-contained character of the turbine, the ease of assembly and dismantling, reliability of service, as instanced by a run without stopping of 17,200 hours, protection of generator from external influences, simplicity of steam distribution, and sensitiveness in speed variation to 1 per cent. or less, within normal ranges of cotton mill loading, instantaneous rather than step control, available forcing capacity, fixed and steady economies of large and small units, extreme compactness and speed of erection. In one cotton mill a 1,500 KW. turbo unit has been erected on one-half of the existing foundation of a 1,200-H.P. cross compound engine, there being sufficient space left to erect another unit of a similar size, giving a total of 4,000 H.P. capacity on a foundation formerly required for 1,200 H.P. In the Fort Wayne central station, the turbines are installed on the second floor of the power-house, supported only by lattice columns. Two 500-KW. turbines were put in operation at the power-house of the Cleveland Electric Illuminating Co., 74·5 hours and 47·5 hours respectfully from the time the machines left the shops. The last machine was actually erected in 13 hours' straight work.

The Faraday Society.

THE USE OF OZONE FOR THE PURIFICATION OF WATER.

AT the meeting of the Faraday Society held on May 12th, DR. F. MOLLWO PERKIN gave an interesting account of the most recent plants now in working order for the production of ozone and its use in the sterilisation of drinking water. As is well-known, ozone is best produced electrically by means of a silent discharge, and its remarkable sterilising properties are due to its being a powerful oxidising agent and thus a bacteriacide. Happily, it is the pathogenic bacteria, like typhoid, which are most amenable to destructive influences; harmless bacteria take much more killing. Of course water that comes from comparatively pure sources, or from rapidly-flowing streams, in which case the accelerated oxidation of the air is sufficiently effective, needs no stronger treatment than passage through ordinary filter beds, but where the water is unduly contaminated, or is likely to be so at any time, filtration alone is unreliable, and then specially drastic purification, like ozone treatment, becomes imperative. The ozone process in its broad outlines is simplicity itself. The water is raised mechanically to high towers, about 4 metres high, and in order to sub-divide it as much as possible, is allowed to trickle down in a fine shower over layers of pebbles. Here it meets with an uprising stream of ozonised air and the contact kills the pathogenic germs. Dr. Perkin described in some detail, from data specially furnished by Dr. G. Erlwein, the Siemens & Halske sterilising process as carried out at Paderborn and Wiesbaden. The ozoniser consists of an inner aluminium, water-cooled, pipe forming the positive electrode, and a concentric glass cylinder surrounded with water in an iron containing box, forming the negative electrode. In the annular space between the two, dried air passes, and the discharge takes place. A unit cell absorbs about 1 H.P., the voltage being about 8,000, and generates from 13 to 27 gms. per hour. At Paderborn and Wiesbaden the water requires about 1·3 gms. of ozone per cubic metre, hence, taking the consumption of water at the low figure of 100 litres per head, a unit ozoniser will purify in 24 hours the water supply of from 2,400 to 4,800 persons. After the water has been thus treated, it is allowed to flow into the reservoir in a series of cascades, thus coming into contact with the air and removing any excess of ozone. In the case of interruption to the electric supply or the blowers, the sterilising towers are automatically shut off by an ingenious system of electro-magnetic valves, thus preventing the flow of impure water into the town mains.

The cost of operating the process is very moderate. In a steam plant capable of dealing with 2,000 cb. metres of water of average purity per hour, it works out at about 0·075d. per cb. metre, and in a 200 cb. metre plant at 0·27d.

Portable sterilising plants are also now largely made, and they were found of great use during the late Russo-Japanese war. In the case of a typhoid or similar epidemic they should prove invaluable for house-to-house supply of uncontaminated water.

Dr. Perkin finally touched briefly upon other industrial uses for ozone. One of these is the oxidation of engenol for the preparation of artificial vanilla, a process now working at Niagara Falls. Another most interesting application is in the bleaching of flour and wheat, a process used in many mills in this country. Suitably ozonised air passing at the rate of about 100 cb. ft. per minute will sterilise and bleach to a magnificent whiteness three tons of flour per hour. The sterilising is most marked; the treatment reduces the number of micro-organisms in wheat flour from 540 to 170 per gm. Flour so treated is capable of export for long distances, or may be kept for long periods of time without deterioration.

Dr. V. H. Veley, F.R.S., exhibited an apparatus for the determination of the dielectric constants of non-conducting liquids. In the usual bridge method, balance is obtained by varying a resistance. In the author's apparatus a capacity is varied in such a way that variations are proportioned to the distance traversed by the movable condenser plate. These are read off directly, and a simple calculation gives the specific inductive capacity under measurement.

TRADE STATISTICS OF THE STRAITS SETTLEMENTS, 1906.

THE following statement showing the imports of electrical and other materials into the various Straits Settlement ports in 1906 is taken from the recently issued trade statistics; the figures for 1905 are given for purposes of comparison, and notes of any increases or decreases have been added:—

IMPORTS INTO SINGAPORE.

	1905. Dollars.	1906. Dollars.	Increase or decrease. Dollars.
Gas and Electric Lighting Materials.—			
From Germany	15,575	1,125	— 14,750
„ Holland	—	4,190	+ 4,190
„ United Kingdom...	123,932	155,869	+ 31,937
„ United States ...	12,620	6,766	— 5,854
„ Other countries ...	3,997	4,365	+ 368
Total	156,424	172,315	+ 15,891
Telegraph and Telephone Materials.—			
From Belgium	96,629	56,315	— 40,314
„ Germany	55,900	34,045	— 21,855
„ United Kingdom...	97,967	234,082	+ 136,115
„ Other countries ...	20,379	11,571	— 8,808
Total	270,875	336,013	+ 65,138
Tramway and Railway Materials.—			
From Belgium	65,831	31,963	— 33,868
„ Germany	—	1,745	+ 1,745
„ United Kingdom ...	518,152	118,643	— 399,509
„ Other countries ...	34,499	31,776	— 2,723
Total	618,482	184,127	— 434,355
Machinery.—			
From Belgium	31,775	39,007	+ 7,232
„ France	56,259	14,220	— 42,039
„ Germany	53,285	76,666	+ 23,381
„ Holland	10,440	52,719	+ 42,279
„ United Kingdom ...	657,230	688,205	+ 30,975
„ United States ...	85,542	161,332	+ 75,790
„ Other countries ...	56,124	64,977	+ 8,853
Total	950,655	1,097,126	+ 146,471
Lamps and Lampware.—			
From Belgium	29,883	28,615	— 1,268
„ Germany	159,912	203,100	+ 43,188
„ Holland	4,150	2,855	— 1,295
„ United Kingdom ...	69,690	90,512	+ 20,822
„ United States ...	43,841	21,866	— 21,975
„ Other countries ...	57,159	43,686	— 13,473
Total	364,635	390,634	+ 25,999

IMPORTS INTO PENANG.

	1905. Dollars.	1906. Dollars.	Increase or decrease. Dollars.
Gas and Electric Lighting Materials.—			
From Germany	7,254	79,426	+ 72,172
„ United Kingdom...	120,458	102,920	— 17,538
„ United States ...	420	1,250	+ 830
„ Other countries ...	16,103	4,028	— 12,075
Total	144,235	187,624	+ 43,389
Telegraph and Telephone Materials —			
From United Kingdom ...	3,804	780	— 3,024
„ Other countries ...	1,120	3,705	+ 2,585
Total	4,924	4,485	— 439
Railway and Tramway Materials.—			
From Germany	—	600	+ 600
„ United Kingdom ...	139,255	700	— 138,555
Total	139,255	1,300	— 137,955
Machinery.—			
From Belgium	5,627	14,865	+ 9,238
„ Germany	15,542	35,593	+ 20,051
„ United Kingdom ...	219,773	332,278	+ 112,505
„ Singapore	8,880	22,951	+ 14,071
„ United States ...	1,900	25,335	+ 23,435
„ Other countries ...	15,340	24,140	+ 8,800
Total	267,062	455,162	+ 188,100
Lamps and Lampware.—			
From Austria	1,595	3,390	+ 1,795
„ Belgium	2,005	3,700	+ 1,695
„ Germany	20,886	45,787	+ 24,901
„ Singapore	3,875	6,472	+ 2,597
„ United Kingdom ...	27,675	56,491	+ 28,816
„ Other countries ...	14,194	9,283	— 4,911
Total	70,230	125,123	+ 54,893

IMPORTS INTO MALACCA.

Gas and Electric Lighting Materials.—			
From Singapore	20	256	+ 236
„ Other countries ...	413	—	— 413
Total	433	256	— 177
Telegraph and Telephone Materials.—			
From Singapore	149	619	+ 470
„ United Kingdom ...	1,545	119	— 1,426
„ Other countries ...	—	50	+ 50
Total	1,694	788	— 906
Tramway and Railway Materials.—			
From Singapore	39,522	1,237	— 38,285
„ United Kingdom ...	62,766	12,045	— 50,721
„ United States ...	26,663	—	— 26,663
„ Other countries ...	13,619	2,895	— 10,724
Total	142,570	16,177	— 126,393
Machinery.—			
From Singapore	3,939	17,785	+ 13,846
„ United Kingdom ...	1,220	862	— 358
„ Other countries ...	—	595	+ 595
Total	5,159	19,242	+ 14,083
Lamps and Lampware.—			
From Singapore	4,972	6,240	+ 1,268
„ Other countries ...	30	249	+ 219
Total	5,002	6,489	+ 1,487

N.B.—The rates of exchange of the dollar in 1905 averaged 2s. 0½d., and in 1906 2s. 4d.

Corporation Officials and Pupils.—The question whether corporation officials should be permitted to take paying pupils has again been discussed by the Blackburn General Purposes Committee. The practice has never been formally sanctioned by the Town Council. Objection was recently raised to Mr. Wainwright, electrical engineer, taking a pupil, and the matter has since been in abeyance. It was decided that the practice be sanctioned in the case of the present officials, but that it should be understood that new officials would not enjoy this privilege.

ELECTRICITY AT A MINT.

THE recently-completed Ottawa branch of the Royal Mint contains several features of interest from an electrical standpoint, and forms an instructive example of the increasing use of electric drives for manufacturing processes.

The Mint was formally opened on January 2nd last. The building is situated close to the Ottawa River. The cost of erection was £52,600, and machinery has been installed to the value of £22,000.

The following particulars are taken mainly from a paper read by the Superintendent, Mr. A. H. W. Cleave, before the Canadian Society of Civil Engineers.

A two-phase supply, by the Ottawa Electric Co., enters the building at a pressure of 2,140 volts and a periodicity of 60. This is led to the primaries of six oil-insulated, self-cooled transformers. The secondaries of three of these are wound for a pressure of 500 volts, and those of the remaining three for 107 volts. The former are for the power load, and have a full-load rating of 100 KW. each, whilst the latter are for lighting purposes, and have a 15 KW. rating. In each case one is, of course, a spare, and in the event of a breakdown can be put into circuit on either phase.

As the motors throughout are C.C. machines, it has been necessary to install a motor-generator set. The A.C. side of this is an induction motor rated at 170 KW., whilst the C.C. generator is a compound wound machine, rated at 150 KW., and operating at 225 volts.

At present the motor load consists of 32 compound wound machines ranging in power from 1½ to 30 H.P. These are all wound for a working voltage of 220, and the leads throughout are carried in steel conduits.

The heaviest work is done in the rolling room where the gold, silver, and bronze bars, as the case may be, are rolled to the required thickness, after having been melted and poured into moulds of suitable size and shape in the melting house. There are three mills in this room driven separately by motors of 30, 20 and 10 H.P. The latter run at 600 R.P.M. and, by means of second motion shafts, the speed of the rolls is reduced to 40, 50 and 60 R.P.M. respectively.

After the bars have been passed through the breaking down mill from 10 to 12 times, annealing becomes necessary. The bar or fillet annealing furnace is regulated and heated in a similar manner to that described below in connection with the annealing room. The fillets are next passed through the thinning-down mill from eight to ten times, and five or six times through the finishing mill. From the rolling room they are taken to the cutting room, and the blanks are cut. The cutting machines in use are each capable of cutting 300 blanks per minute, and are separately motor-driven.

The blanks thus produced are then annealed, preparatory to the operation of striking in the coining presses.

The annealing furnace, which is motor-driven, is heated by means of oil fuel mixed with steam at a pressure of 60 lb. per sq. in. The passage of the blanks through the furnace is regulated by a speed box attached to the motor.

The three coining presses installed are each capable of striking 100 coins per minute. They are also separately motor-driven, and so arranged that the drive can be made either through a gear or by belting.

After being weighed, overlooked, and, in the case of gold and certain denominations of silver, rung separately on an iron block to ensure that no "dumb" pieces are issued, the coins are delivered to the main office.

In the machine shop where repairs, &c., are carried out, a number of up-to-date machines have been installed. A roll grinder and a planing machine are separately motor-driven whilst the others are grouped.

The wiring for the lighting of the buildings is laid in interior conduits. As previously stated, the system is two-phase at 107 volts, and is in conformity with the lighting arrangements of the city. The buildings are also wired for electric bells, clocks and telephones, which are in use throughout the Mint.

Electric Supply Football League.—The 1st annual general meeting of this league was held at 19, Carnaby Street, W., on Wednesday last week, Mr. T. C. Brice presiding over a large attendance. The most important item on the agenda was the extension of the league, by the alteration of Rule 1, so as to include any football club connected with the electrical industry, whose ground is situated within 15 miles of Charing Cross. This alteration was carried unanimously, and the following clubs were elected:—The General Electric F.C., Robertson's F.C., G.P.O. (Electric Dept.), and the Ediswan F.C. Callenders and County of London Electric are also prospective members. A special general meeting has been called for Wednesday, June 17th, at 19, Carnaby Street, W., 7.30 p.m. Any clubs who may still wish to join are invited to attend this meeting or communicate with the hon. secretary, Mr. J. W. Fraser, 39, Wearside Road, Lewisham, S.E. It was decided to hold a smoking concert at the beginning of the football season, when the cup and medals will be presented to the Metropolitan Electric F.C.

NEW PATENTS APPLIED FOR, 1908.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

10,719. "Improvements in or relating to magneto-electric ignition apparatus." H. W. VAN RADEN. May 18th.

10,723. "Improvements in surface contact for electrical traction." J. W. FILLIS. May 18th.

10,729. "Improvements in telephone receivers which may be used as transmitters." A. MARR and T. CHALMERS. May 18th.

10,739. "Novel or improved means for use in operating lock bolts by means of electricity applicable in a modified form for locking and latch bolt by means of electricity, and adaptable also in a modified form for use alternatively with a locking or latching bolt." T. O. SUMMERS and T. HILL. May 18th.

10,759. "Improvements in means for regulating the current in electric heating appliances." N. E. BEVES and THE BRITISH PROMETHEUS CO., LTD. May 18th.

10,760. "Improvements in and relating to luminous electric radiators." THE BRITISH PROMETHEUS CO., LTD., G. COOPER and F. C. SHARP. May 18th.

10,764 and 10,767. "Improvements in storage battery plates." A. O. TATE. (Date applied for under Rule 13, December 20th, 1907. An invention comprised in application No. 28,132, dated December 20th, 1907.) May 18th. (Complete.)

10,768. "Improvements in storage battery plates." A. O. TATE. Particulars same as 10,767.

10,769. "Improvements in storage battery plates." A. O. TATE. (Date applied for under Rule 13, December 20th, 1907. An invention comprised in application No. 28,106, dated December 20th, 1907.) May 18th. (Complete.)

10,773. "Improvements in and connected with holders for electric lamps." A. F. ROCK. May 18th.

10,784. "Improved method of controlling electric motors for tramcars, lifts and the like." THE JOHNSON-LUNDELL ELECTRIC TRACTION CO., LTD., and W. A. PRICE. May 18th.

10,792. "Improvements in and relating to electric radiators or heaters." C. N. NETTLEY. May 18th.

10,808. "Improved method of producing pure metallic filaments for incandescent electric lamps." C. H. DORMAN. May 19th.

10,820. "New or improved anti-vibrating lead terminal for electrical ignition motors and the like." J. WOOD and W. WOOD. May 19th.

10,825. "New or improved electrical device for illuminated stage dancing." A. QUINN and R. BROUGHTON. May 19th.

10,829. "Improvements in electrical conductors." I. KITSEE. May 19th. (Complete.)

10,838. "Improved apparatus for electrically igniting miners' safety lamps in mines." J. C. BEST. May 19th.

10,845. "Improvements in and relating to dynamo-electric machines." CROMPTON & CO., LTD., J. C. MACFARLANE and H. BURGE. May 19th. (Complete.)

10,848. "Improvements in electric terminals or clamps." J. BERRYMAN. May 19th.

10,860. "Improvements in and relating to electrical time switches." J. JONES and J. JONES, jun. May 19th.

10,885. "Improvements in and relating to the manufacture of filaments for electric incandescent lamps." WOLFRAM-LAMPEN AKT.-GES. (Date applied for under Sec. 91 of the Act, November 29th, 1907, being date of application in Germany.) May 19th. (Complete.)

10,889. "Improvements in carbon holders for electric arc lamps." R. CHAUDET *nee* WARNENT. (Date applied for under Sec. 91 of the Act, November 29th, 1907, being date of application in Belgium.) May 19th. (Complete.)

10,891. "Improvements in and relating to the manufacture of filaments for electric incandescent lamps." WOLFRAM-LAMPEN AKT.-GES. (Date applied for under Sec. 91 of the Act, October 4th, 1907, being date of application in Germany.) May 19th. (Complete.)

10,893. "Improvements in electricity meters." CHAMBERLAIN & HOOKHAM, LTD., and S. H. HOLDEN. May 19th.

10,918. "Improvements in electrical ignition apparatus for internal combustion engines." H. BEVIS and H. J. COATES. May 20th.

10,928. "Improvements in apparatus for protection of electrical circuits and apparatus." J. W. TURNER. May 20th.

10,937. "Improvements in apparatus for electrically lighting the mouth and cavities beyond during dental and other surgical operations." C. GALPIN and J. BAXTER. May 21st.

11,000. "Improved form of mercury jet interrupter." G. E. GAIFFE. May 21st.

11,029. "Improvements in or relating to electric automatic call boards and apparatus connected therewith." J. APPLEBY and A. E. DREW. May 21st.

11,040. "Improvements in switches for electric lighting and purposes therefor." F. HODGSON. May 21st.

11,085. "Improvements in electric batteries." THE NEW IGNITION SYNDICATE, LTD., and W. J. L. SANDY. May 21st.

11,061. "Improved form of electric break or interruptor." E. E. T. B. GREVILLE. May 21st.

11,064. "Improvements in and relating to starting switches for electric motors." D. TIMAR and K. VON DREGHR. (Date applied for under Sec. 91 of the Act, June 5th, 1907, being date of application in Germany.) May 21st. (Complete.)

11,068. "Improvements in electro-mechanical regulators or governors for electric generators, electric furnaces, and the like." J. L. ROUTIN. (Date applied for under Sec. 91 of the Act, May 24th, 1907, being date of application in France.) May 21st. (Complete.)

11,099. "Improvements in apparatus for transmitting telegraphic signals." W. HAMILTON. May 22nd. (Complete.)

11,105. "Improved process for treating electrolytic copper during melting in a reverberatory furnace." H. DAVIES. May 22nd.

11,106. "Improvements in portable electric lamps." H. F. JOEL. May 22nd.

11,119. "Improved dynamo for motor-cars and other vehicles." L. BACHTEN and J. GALLAY. May 22nd. (Complete.)

11,128. "Improvements in electric heating apparatus." M. HANKIN. (Date applied for Sec. 91 of the Act May 27th, 1907, being date of application in Belgium.) May 22nd. (Complete.)

11,134. "Improvements in electrical induction clutches." A. P. STECKEL and F. DU P. THOMPSON. May 22nd. (Complete.)

11,135. "Improvements in or relating to telephony and telegraphy." S. G. BROWN. May 22nd.

11,136. "Improvements in electrical induction clutches." A. P. STECKEL. May 22nd. (Complete.)

11,153. "Improvements in or connected with electric cables." S. PATERSON and D. A. S. PORTEOUS. May 22nd.

11,158. "Improvements in appliances for notifying the extinction of a lamp or other flame and, or, automatically replacing it by an electric light." W. A. JONES and G. S. BOWLER. May 22nd.

11,161. "Improvements in and relating to dynamo-electric machines." THE BRITISH THOMSON-HOUSTON CO., LTD. (Allgemeine Electricitats Gesellschaft, Germany.) May 22nd. (Complete.)

11,163. "Improvements in submarine signalling cable." T. PETERSEN and CALLENDER'S CABLE AND CONSTRUCTION CO., LTD. May 22nd.

11,170. "Improvements in and relating to induction coils." J. B. BROOKS and F. H. ALSTON. May 22nd.

11,175. "Improved electro-magnetic switch for tramway lines." A. KOHLER and F. KOHLER. May 22nd. (Complete.)

11,183. "Electrical circuit-breakers." B. THOMAS and E. THOMAS. May 23rd.

11,191. "Improved means of making electric light or power." J. MABBETT. May 23rd.

11,193. "Electric ring game." E. MCKAIG. May 23rd. (Complete.)

11,224. "Improvements in electric bell systems and means for operating same." J. M. YOUNG. May 23rd.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. THOMPSON & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1906.

ELECTRIC SIGNALLING APPARATUS. Felten & Guilleaume Lahmeyerwerke Akt.-Ges. 21,847. September 26th. (Date applied for under International Convention, October 4th, 1905.)

1907.

PROCESS FOR THE MANUFACTURE OF ELECTRIC INSULATING MATERIALS, ALSO SUITABLE FOR BUILDING PURPOSES. Wunner'sche Bitumenwerke Ges. 18,101. August 9th. (Date applied for under International Convention, April 29th, 1907.)

ELECTRO-MOTORS. C. A. Allison. (H. Behan, United States.) 21,077. September 23rd.

SINGLE-PHASE SERIES ALTERNATING-CURRENT COMMUTATOR MOTORS. M. C. A. Latour. 21,827. October 3rd. (Date applied for under International Convention, October 3rd, 1906.)

ELECTRIC BATTERIES. K. Schwarzwalder. 22,085. October 7th.

ARC LAMPS. D. Tinar and K. von Dreger. 23,199. October 21st. (Date applied for under International Convention, September 4th, 1907.)

APPARATUS FOR CONNECTING, CONDUCTING AND OTHER WIRES. A. Fodor. 23,618, October 25th.

ELECTRICAL LOCKING APPARATUS FOR RAILWAY SIGNALS. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges., Germany.) 26,920. December 5th.

COIN-OPERATED APPARATUS FOR CONTROLLING THE SUPPLY OF ELECTRICITY. E. Evans. 26,937. December 5th.

MEANS FOR MAKING ELECTRICAL JOINTS OR CONNECTIONS. C. W. Denny. (C. C. T. Eastgate and D. J. Horne, India.) 27,723. December 17th.

ELECTRIC VEHICLE OR LOCOMOTIVE BRAKES. J. F. Simpson. 9,390. April 23rd.

COMBINATION ELECTRIC FUSE AND SWITCH. V. Mainprize. 9,434. April 23rd.

ELECTRO-DEPOSITION OF IRON. S. O. Cowper-Coles. 10,367. May 3rd.

ELECTRIC TRACTION INSTALLATIONS USING CONTACT BOXES. P. B. Black and T. H. Black. 10,636. May 7th.

ELECTRICAL APPARATUS FOR TRANSMITTING AND RECEIVING SIGNALS. A. T. Dawson and G. T. Buckham. 10,650. May 7th.

INCANDESCENT ELECTRIC LAMPS. T. W. Lowden and Westinghouse Metal Filament Lamp Co. 13,882. June 15th.

DYNAMO-ELECTRIC MACHINES. Siemens Bros. Dynamo Works, Ltd., and W. Parker. 16,051. July 12th.

ELECTRICAL SWITCHES. T. L. Boyden. 19,855. September 7th.

CASE FOR ELECTRIC INDICATORS. H. Zander. (R. Held.) 22,224. October 8th.

AUTOMATIC SAND-VALVE OPENER FOR TRAMCARS AND OTHER ELECTRICALLY-DRIVEN VEHICLES. F. J. S. Hosken. 25,961. November 23rd.

SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. Simms Manufacturing Co. and A. H. D. Altree. 28,142. December 20th.

ELECTRICAL APPARATUS FOR TRANSMITTING AND RECEIVING SIGNALS. A. J. Dawson and G. T. Buckham. 2,986. February 6th.

ROTARY TRANSFORMERS PERMITTING THE TRANSFORMATION OF ALTERNATING CURRENT INTO CONTINUOUS CURRENT AND *vice versa*. A. Heyland and D. Korda. 4,988. March 1st. (Date applied for under International Convention, June 20th, 1906.)

ELECTRIC FURNACE. G. Igevsky. 5,801. March 5th.

MANUFACTURE OF WATERPROOF PAVING SLABS, BUILDING BLOCKS, ROOF COVERINGS, ELECTRIC INSULATORS AND THE LIKE. W. H. Coward. 10,065. April 30th.

APPARATUS FOR CONTROLLING ELECTRIC COOKING AND HEATING APPARATUS AND THE LIKE, AND INDICATING WHEN THEY ARE IN USE. G. M. Newbery and the British Prometheus Co. 10,119. May 1st.

ELECTRIC FIRE ALARMS AND THERMO-INDICATORS. A. H. McNeil. 10,159. May 1st.

CONTROLLING DEVICES FOR ELECTRICALLY-OPERATED WINDING ENGINES. Allgemeine Elektricitäts Ges. 10,171. May 1st. (Date applied for under International Convention, May 2nd, 1906.)

ARC LAMPS AND ELECTRODES FOR USE THEREIN. H. Beck. 10,513. May 5th. (Date applied for under International Convention, May 5th, 1906.)

METHODS OF AND APPARATUS FOR BRAKING ELECTRICALLY-PROPELLED VEHICLES. G. H. Condict. 10,515. May 6th. (Date applied for under International Convention, May 9th, 1906.)

LEAKAGE DETECTORS FOR SURFACE-CONTACT ELECTRIC TRACTION SYSTEMS. E. A. Mitchell. 10,641. May 7th.

ARC LAMP. C. C. Winther-Hansen and P. Bouchstein. 10,662. May 7th.

SWITCHES, FUSES AND THE LIKE. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 10,665. May 7th.

ELECTRIC SWITCHES. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 10,666. May 7th.

1908.

SPACE TELEGRAPHY. L. de Forest. 1,427. January 21st. (Date applied for under International Convention, January 24th, 1907.)

ELECTRICAL PATTERN FOR THE MANUFACTURE OF JACQUARD CARDS. P. Weissenborn. 35. January 1st.

RADIO-TELEGRAPHY. Amalgamated Radio-Telegraph Co. 892. January 14th. (Date applied for under International Convention, January 14th, 1907.)

ELECTRIC ARC ILLUMINATING APPARATUS MORE PARTICULARLY FOR USE IN PHOTOGRAPHY. J. Schmidt. 3,740. February 18th. (Application for patent of addition to No. 9,574/07.)

ELECTRICALLY-CONTROLLED PNEUMATIC DISPATCH TUBES, CASH RAILWAYS, AND THE LIKE. C. W. Bluemel, F. A. Bluemel, E. H. Bluemel and P. R. Shill. 3,770. February 19th.